OCTOBER 21, 1957

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Research AND Development EDITION

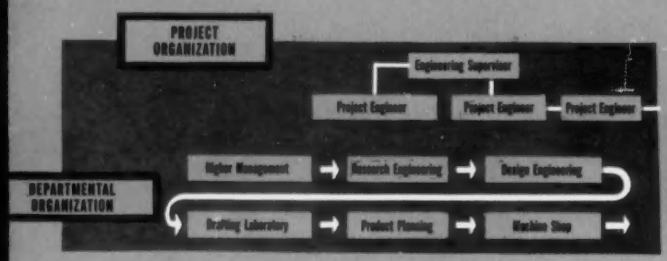
Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN
RESEARCH AND DEVELOPMENT

Young America...

DESIGNS

see page 32



Best setup for R&D...

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A look at year 2000...

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Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

October 21, 1957 Vol. 28, No. 16

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Product Engineering

..SIDELIGHTS

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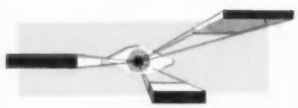
The State Department notwithstanding,

American students are our best representatives in Europe and the USSR. They made a lasting impression (despite some questionable publicity) at the World Youth Festival in Moscow earlier this year and promise to do even better with the "Young American Industrial Designers" exhibit (see page 32) leaving for Europe and Asia this month. Kids are enthusiastic and believable and by trusting them to represent us perhaps we can create more understanding in the hearts of strangers.

Tomorrow and tomorrow and tomorrow—

predictions range from Utopia to a radiation-destroyed world. Top management seems to be spending all its time nowadays looking into crystal balls (see page 19)—and maybe that's its job. But we'd like to add one small reminder: "Study as if you were to live forever," as the wise man said, but "Live as if you were to die tomorrow."

Where does standardization end



and justifiable individuality begin? The NATO is having real problems with weapon standardization (Sept. 23 '57, p. 27), but interchangeability is practically essential in war. Consumer products, particularly when mass-produced, must also be standardized (see page 36). Yet it is terrifying to see a half million men driving exactly similar cars, wearing the same-styled gray flannel suits, or living in identical homes. Remembering our heritage of independence, just how far toward conformity are we willing to go?

With shorter working hours and more leisure

time, people have enthusiastically turned to hobbies and home-workshop tasks. This opens new markets (see PPS, page 52) but, oddly enough, closes some as well. At any rate, our editors have taken up the do-it-yourself fad with a will. One is in the process of rebuilding his home. Two or three have built hi-fi sets from the chassis up. But it was a bit disquieting to discover a collector of shrunken heads in our midst . . .

ABP OCTOBER 21, 1957 **Product Engineering** *A McGRAW-HILL PUBLICATION* Vol. 28, No. 16 ABC

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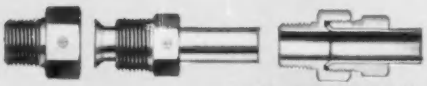

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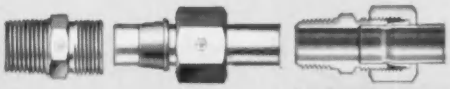

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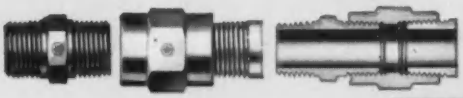

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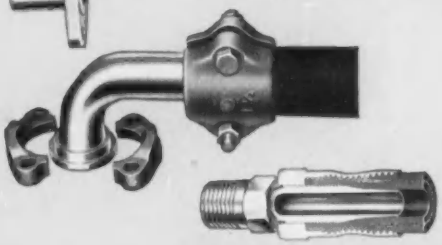

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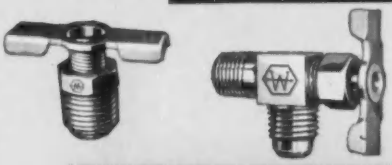

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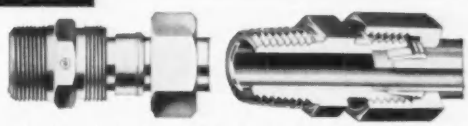

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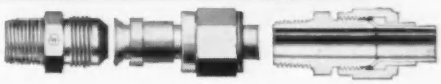

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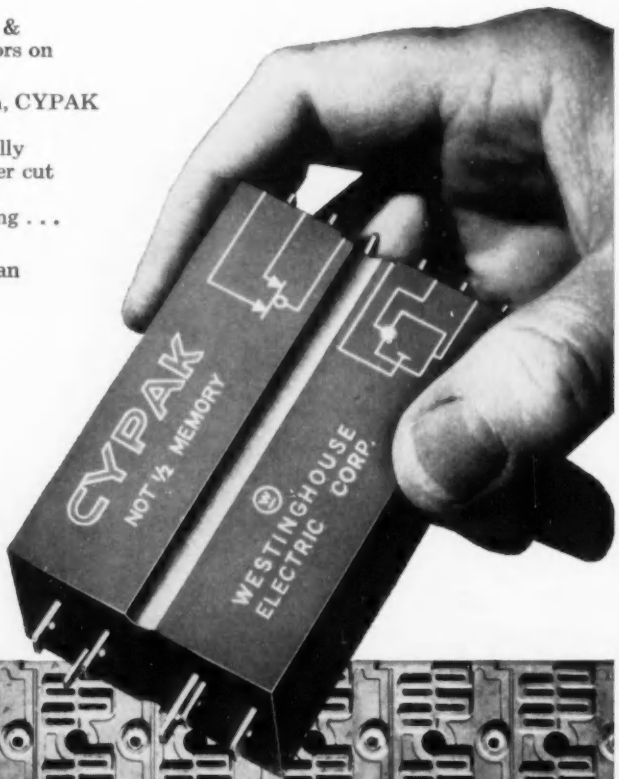

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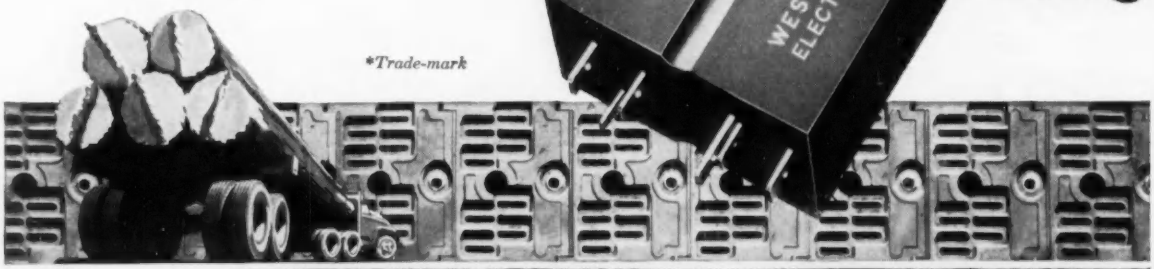
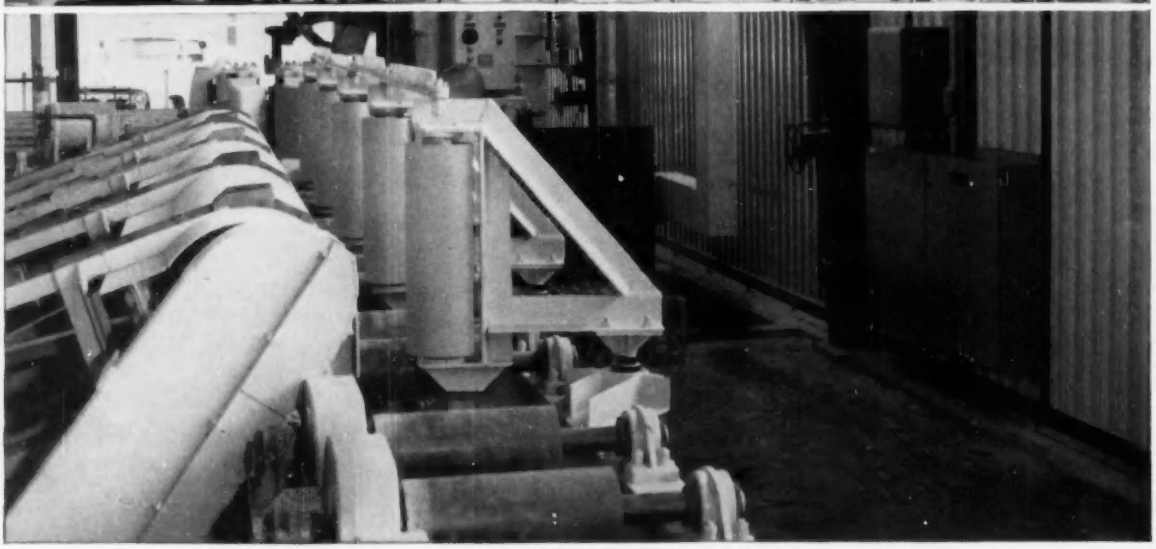




DEVELOPMENTS TO WATCH...

Materials of great stability . . .

. . . hardness, and corrosion resistance, are being sought–and found–in a joint government-industry program to develop better materials for precision gage blocks. Results so far are very promising.

Says T. G. Digges, the National Bureau of Standards chief of thermal metallurgy research: "Results obtained to date in nitriding AISI 410 stainless steel blocks appear promising in that the experimental blocks possessed an excellent surface finish, high surface hardness, and good corrosion resistance." Also under NBS test are improved hardening and stabilizing procedures for other base materials, different forms of diffusion coatings, flame plating with a carbide and a ceramic (corundum), electroplating, and hard facing.

What the dimensional stability and wear resistance of these blocks will be over a long period is not, of course, known as yet. But tests are being made–at NBS and the labs of such cooperating companies as Sheffield Corp. Plans for 1958 include studies aimed at determining optimum conditions for hardening and stabilizing selected grades of steel, nitriding the stainless steels and Nitralloy, and application of chrome plating, chromizing, and oxide coatings.

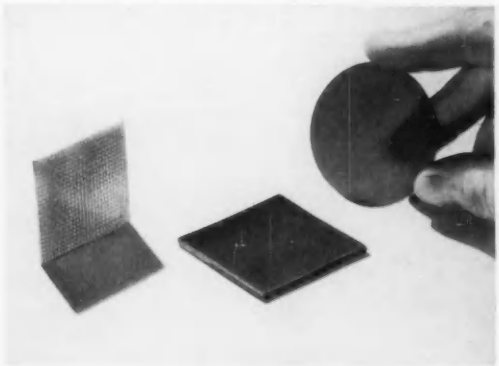
Fuel that won't burn?

. . . It could save a lot of lives in transportation accidents and home fires. But how can you get energy from a nonflammable fuel unless you take the nuclear route? *Chemical Week* recently suggested two ways: The fuel could be in the form of two inert fluids that would ignite only when combined inside the combustion chamber; or the fuel might have a flame-inhibiting additive that would somehow be eliminated under engine operating conditions—perhaps by vaporization or neutralization.

A third possibility might be a compound flammable only in the presence of both heat and a catalyst.

All of these would be costly, but the need is so great that such research is being encouraged—and there's no reason why it can't succeed.

Coming up, in plastics . . .



Fluorcarbon-glass laminates (left) for service under tough conditions, and a new decorative and insulating material (right) are ready for design applications. The laminates, now in pilot production at Fluorulon Laboratories, Inc., P. O. Box 305, Caldwell, N. J., are said to be unusually hard (65 Rockwell M) and able to stand temperatures to 425 F. One type uses glass-fiber grids (left); another is made with pulverized microfibers.

New Scandinavian process makes unusual shapes like these possible. Extruded plastic tubing is wound around a form, then bonded with a special adhesive spray. The process (Rotaflex), now licensed to and improved by The Heifetz Co., Clinton, Conn., has so far been used primarily for lamp shades, but Heifetz believes flexibility of the process and its ability to combine thermal insulation with light control, should find many other applications.

American...

(continued)

DEVELOPMENTS TO WATCH...

Air-propelled Liberty ship . . .

. . . with turbo-prop engines installed on deck in gun mounts is under test by the Navy. They're real aircraft engines—taken from a Lockheed Constellation—and from early trials Navy says this method of propulsion "shows real promise for ships up to 14,000 tons, when speed is not essential."

Meanwhile, work on gas turbines specifically designed for ship propulsion is continuing apace. Two Solar Aircraft Jupiter T-50 engines came through a 1,500-hr minesweeper trial with flying colors. Indeed, it's beginning to look like control equipment, rather than engine design, should get top priority. D. E. Blackwood of the Bureau of Ships, and W. P. Henry, Jr. and P. W. Pichel of Solar told a recent ASME meeting "there was no failure in any of the high-speed rotating turbine parts," but there is a need for "reliable accessory equipment that can be supplied at more reasonable cost."

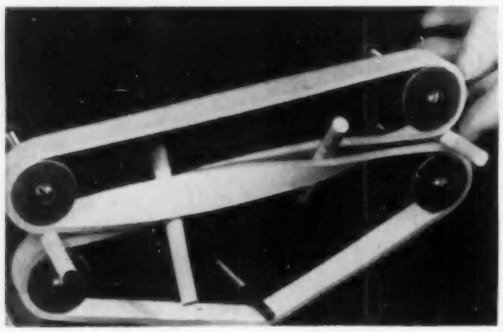
Wanted: by the Army . . .

. . . a spate of new photographic techniques that would permit photography at night, make it easy to develop pictures on the battlefield, and simplify extraction of essential information from the thousands of films the Army takes. A photographic film, sensitive in the visible spectrum but unaffected by nuclear radiation, is also needed. It will take new developments in optics and equipment design, as well as new chemical compounds, to reach these goals. Brig. Gen. Earle F. Cook says the Signal Corps is already sponsoring research on a "dry-process" developer and ultra-high-speed films. But it would certainly welcome additional efforts—particularly in product design.

Metallic fillers don't affect . . .

. . . thermal resistance of adhesive bonds made with phenolic-epoxy resins. That's the surprising conclusion of a study made by Forest Products Laboratory for Wright Air Development Center. Tape adhesives, made by coating glass cloth with inorganic fillers and used to bond aluminum to aluminum, effectively resisted heat aging at 500 F. The supporting medium, however, does make a difference. Glass cloth was much better than glass or asbestos mats. Furthermore, bonds made with tape adhesives did not in general resist thermal aging as well as did liquid-resin bonds. Study is part of a continuing program to develop better structural adhesives for metals. A.R.G.

For delicate parts . . .



Foam-faced belt takes a firm but gentle grip on easily crushed cigarettes, helps R. J. Reynolds engineers automate a difficult operation—turning filter-tip cigaretes over so they're in the proper position for packaging. Belt made of fabric-backed urethane foams is twisted around paired pulleys. Overlapping belt strands grasp cigaretes, turn them end-over-end while moving them along, and release them in proper position as the strands separate. DuPont proudly notes this is one of first such applications for polyester-isocyanate foams. Belt life is a month or more.

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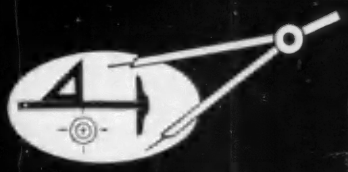


in design

"Non-skid" neoprene reels help dye slippery synthetic fabrics

Gaskets of HYPALON unaffected by 2% ozone after two years' use

For two years, a large chemical firm has used gaskets of HYPALON in its ozone generators. Despite constant exposure to 2% ozone, not one gasket failed because of ozone cracking.

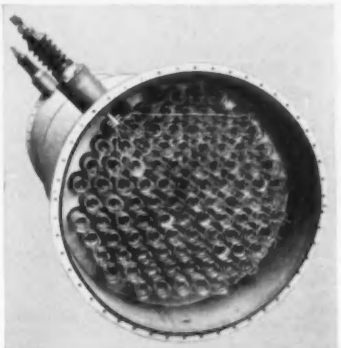
The ozonator is a steel shell packed with glass tubes. As dry oxygen passes through the tubes, it is converted to ozone by high-voltage electrical discharge. Each end of the shell is closed by a dished head sealed with a gasket of HYPALON.

Plastic gaskets too rigid

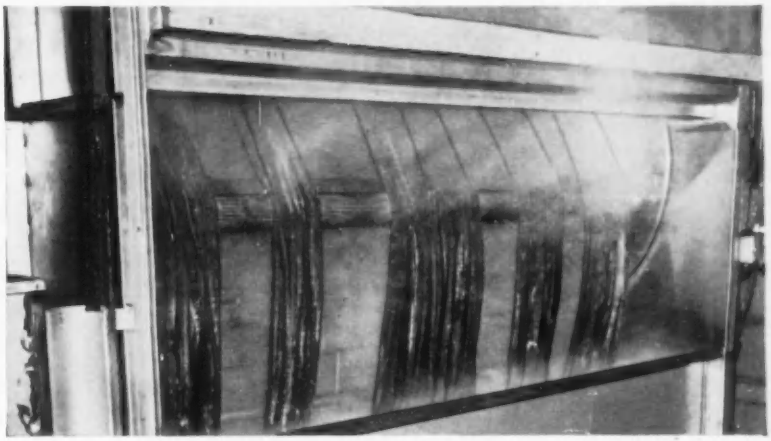
Plastic gaskets, which were formerly used in the generators, were unaffected by ozone, but took a permanent set under flange pressure. When a head was removed for routine maintenance the plastic gasket was too distorted to put back. Gaskets of HYPALON are reused.

Designing with HYPALON

HYPALON offers many additional advantages compared to other types of rubber. It resists strong oxidizing acids; can operate at temperatures from 250° F. to 350° F.; resists weather and sunlight. This Du Pont synthetic rubber can also be compounded in an unlimited range of stable colors. HYPALON offers extra long life and lower operating costs in jobs where conditions are severe. Just mail coupon for full information.



Gaskets made of HYPALON seal each end of this ozonator; they show no deterioration after two years in service.



Fluted neoprene bars show little wear after four years in dye machine. Dye bath may be acid or alkaline, oxidizing or reducing. Temperature is 200° F.

Mill uses neoprene to get needed traction for hauling fabric through dye bath

Chatham Manufacturing Co., of Elkin, N. C., used neoprene to solve an unusual problem in dyeing synthetic fibers. Long loops of the fabrics are dyed in stainless steel piece dyeing machines. Loops, often 100' long, are pulled through the dye bath by means of a reel. The slow rotation of the reel assures even dyeing over the full length of the goods.

The progress of the fabric depends entirely on friction between reel and loop. When several types of metal reels failed to produce enough friction to pull the smooth synthetic fabrics through the bath, Chatham designed special fluted neoprene bars for the reels. They provided adequate traction and ended the problem of slippage and uneven dyeing.

Chemical resistance important

Bars covered with natural rubber could have solved the traction problem but neoprene was chosen for its excellent chemical resistance. In dyeing various fabrics the dye bath may be acid or alkaline, oxidizing or reducing. Each dyeing cycle requires 3-5 hours at 200° F., and the dye machines operate 24 hours a day. Ordinary rubber just couldn't stand this treatment. Chatham's Superintendent of Dyeing, Mr. V. Caton, reports that neoprene has given excellent service for four years with little wear.

Neoprene's resistance to chemicals, heat and abrasion means long-term wear – and economy in many types of service. Mail coupon below for full details on how neoprene can work for you.

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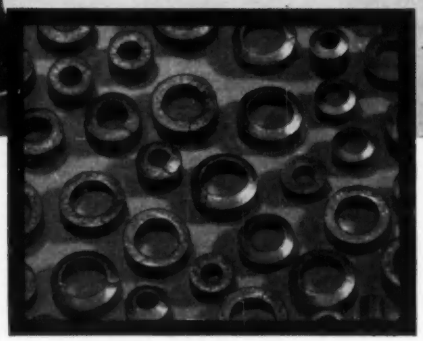

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New Garlock 5022 is the nearest thing to a universal valve stem packing. Its many advantages far outweigh its slightly higher cost. Made of asbestos and TEFLON* pressed into a dense die formed ring, the new packing stands up against steam, water, mild acids, alkalies, and solvents. It is clean, cannot contaminate or discolor the product handled. It contains no graphite or lubricant; the TEFLON acts as an excellent lubricant yet does not exude, dry out, or burn out. Withstands temperatures to 500° F. Ideal for original equipment such as valves, faucets, appliances, etc.

Garlock 5022 and the other Garlock Molded Valve Rings listed at right are available specifically for production line use where accurately sized packings are required for high speed assembly. They are furnished in quantities of 500 and over, in many standard sizes or to your exact specifications.

Molded Valve Rings are another important part of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The *only* complete line. That's why you get unbiased recommendations from your Garlock representative. Call him or write for Valve Ring Data.

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Garlock 161 Rings for use against cold water and alcohol.

Garlock 162 Rings for use against cold oil, gasoline, benzol, chlorinated solvents, etc.

Garlock 163 Rings for use against high and low pressure steam, water, alcohol and some aqueous solutions.

Garlock 166 Rings for use against steam or gases to 600° F. hot or cold water, oils and solvents.

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DEVELOPMENTS TO WATCH...

Pentagon purse strings . . .

. . . are being pulled still tighter. The Air Force has clamped a ceiling on monthly payments to its major contractors for the remainder of fiscal 1958, limiting cash outlays in each case to sums less than payments contractors expected to get.

This comes on the heels of a series of cutbacks, stretchouts, and cancellations–all aimed at keeping Air Force expenditures under $18 billion this year. Air Force has asked contractors to cut in-process inventories and overhead costs, and to borrow money for work in-process before "raising any questions regarding (further) reductions in delivery schedules."

Behind the latest decision is this bitter fact: cost savings resulting from changes in production programs will not be felt early enough to keep Air Force spending under the authorized ceiling.

Before he resigned, ex-Secretary of Defense Wilson said he hoped the Air Force would not bring on "any important change" in delivery schedules. But some contractors are already warning the Air Force that the new monthly payment limitation will mean delays in deliveries.

A lead and zinc price increase . . .

. . . is being promoted by lead-zinc producers who failed to win tariff hikes by Congress last session. Now they have submitted a formal appeal to the Tariff Commission asking for (1) tariff hikes under the escape clause, and (2) quota restrictions.

Tariff increases are limited to 50% of the current rate. But, the commission could step up tariffs per lb to 1.8¢ on the basic lead-zinc import rate, 2.5¢ on pig lead, 2.1¢ on pig zinc.

Guessing in Washington is that higher tariff duties will win Tariff Commission and White House approval. But the bid for quotas–not yet submitted by industry–will be turned down. In the past, the White House has rejected Tariff Commission recommendations for quotas.

Lead-zinc users will have a chance to knock down the tariff proposal. The measure requires Tariff Commission hearings, with users given opportunity to oppose an incraese. Hearings are expected to be set by the Tariff Commission within the next few weeks. After they are held, it will likely take about nine months before a final recommendation is made.

You, too, can be hit by the flu . . .

. . . and Washington is warning industry that its future production might well depend on precautions taken right now. With further epidemics expected, the government is telling firms to waste no time. Most patients recover from the flu in three to five days, but are not able to work several more. And there is a danger of contracting other diseases, after the flu.

For those who want it, the Public Health Service is offering Booklet 56 on the flu from the Supt. of Documents, Gov. Printing Office, Washington 25, D. C. Price: 5¢ a single copy; $3 per 100.

The search for gas-cooled-reactor builders . . .

. . . has brought, on short notice, a surprising response from industry, perhaps because it has a direct bearing on possible aircraft propulsion systems.

At end of August, in response to a directive from Congress to undertake construction of this type reactor, AEC gave potential bidders on the project until Sept. 23 to come forward with proposals. Thirty-one groups have done so–among them is Convair Division of General Dynamics Corp., teamed with Catalytic Construction Co.

Interest by aircraft builders in this bidding chance is not limited to the Convair group. Curtis-Wright Corp. has teamed with General Nuclear Engineering Co. and Ralph M. Parsons Co. in submitting a proposal. AEC currently has a contract with Aerojet General Corp. for a gas-cooled experimental reactor at the National Reactor Testing Station, Idaho Falls, Idaho. General Electric, at the same location, is working on reactor experiments relating to turbojet engines. Pratt & Whitney will operate another aircraft nuclear engine facility for AEC at Middletown, Conn.

The Martin Co. figures in no less than four groups (and it is an alternative in a fifth) which have submitted proposals. Martin, with its own nuclear division, is interested in nuclear reactors aside from aircraft propulsion possibilities. And Aerojet-General has offered a proposal on its own.

World-wide ...

DEVELOPMENTS TO WATCH...

Russians are pioneering in powder metallurgy . . .

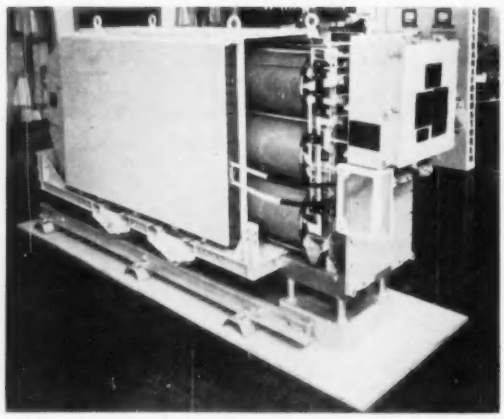
. . . particularly in its theoretical aspects, and they're right up to us on practical applications. Says Dr. H. H. Hausner, US powder-metallurgy expert: "Conversations with Russian powder metallurgists, and an examination of their technical literature, show that there is not a single one of the presently known powder metallurgy methods that is not being carefully investigated in the USSR. Hydrostatic compacting for production of turbine blades has been extensively studied in Russian government laboratories . . . Cermets in general, especially metal-metal oxide mixtures, seem to play an important role."

The Russians are using powdered metal parts for agricultural equipment and electronic instruments, automotive, aircraft and nuclear engineering applications. They are using low-cost sintered iron-graphite bearings for conveyors in place of expensive ball and roller bearings—the iron powder being obtained by atomizing molten cast iron. Metal chips —shavings—are being made into watch mechanism parts by powder metallurgy techniques, with considerable saving of metal. Russian engineers are testing ultrasonic methods to get powder alloys in microcrystalline form, and so improving their properties; and they are applying radioisotope and spectroscopic techniques to study the mechanism of diffusion during sintering.

No-lube bearings . . .

. . . that take advantage of the low coefficient of friction of plastics like nylon and tetrafluoroethylene are attracting as much interest overseas as in this country. Newest English types are bushings and thrust washers of steel-baked, porous bronze impregnated with the fluorine plastic. Advantages: They can run submerged in alkalis, acids, and other liquids; can be used where grease is undesirable (food and textile equipment, for instance). Glacier Metal Co., Ltd., Middlesex, is making them, and samples are available for test from Johnson Bronze Co., Newcastle, Penna.

At the Hannover Fair . . .



Mobility keynotes many of the new designs shown at West Germany's big industrial exposition. This Dominitwerke traveling transformer, for hazardous areas, has heavily braced coils and connecting wires to prevent short circuits. Motor bonnet, flanged motor, and front bumper beam are removable so over-all length can be reduced to less than 6 ft for transport.

Self-propelled batch-weigher has direct-connected four-stroke gas engine with three forward and one reverse speeds, will travel up to 9 mph. Exhibits at Fair showed that, while many new features are being introduced, much of the equipment retains the sturdy—sometimes bulky—styling long characteristic of German design. But lines are clear and strong; over-all appearance attractive.

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What's happening in SCIENCE

H-bomb tamed in England?

That's what the headlines said. The facts are somewhat less exciting, though still important.

Britain, like the US and Russia, is working on methods for achieving the ultra-high temperatures necessary to make the fusion (H-bomb) reaction take place, without exploding an A-bomb to do it. In the laboratory they now appear to have reached a temperature of nearly 5 million F—well above the highest so far reported by US and Soviet scientists. At this temperature, Sir John Cockcroft says, a fusion reaction may have taken place—on a miniscule scale.

To get a controlled, continuous fusion reaction, scientists believe a temperature of perhaps 30 million F would be required. No one has claimed to have reached this pinnacle. The British are optimistic, though; hope to be building power fusion reactors "in the foreseeable future."

Better finishes? Basic data needed

Can new-type finishes—perhaps more resistant to heat and erosion—be developed from the newer types of resins, the polyurethanes, polycarbonates, epoxies? The Navy would like to know.

Pointing out that "development of the full potentialities of these resins as film-forming materials has received only preliminary attention," the Naval Research Laboratory is initiating a major program of basic research. This, it hopes, will lead to developing new coatings that will "greatly allay a number of existing problems in aircraft design," and should contribute to design of other equipment as well. Also to be studied: butyl titanate, "a material promising excellent heat resistance."

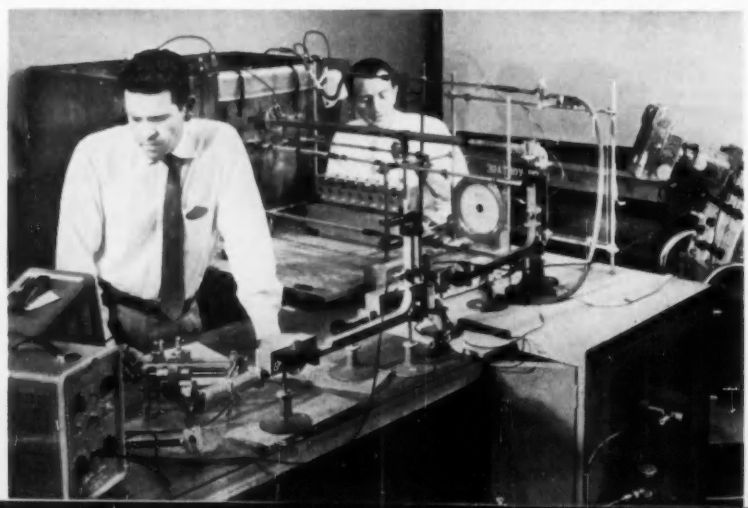
New check on stress corrosion

There are at least two types of stress-corrosion failure, the Naval Research Laboratory points out, but distinguishing between them hasn't been easy. Visual inspection of the fracture just doesn't do the job. It's good news, then, that a simple, accurate technique—based on a plotting of time-to-failure in the presence of an externally impressed current—is now ready for use.

As NRL explains, "many fundamentally different materials, including martensitic, ferritic, and austenitic steels, are observed to crack under stress in the presence of certain corroding environments, the mechanism being one of selective dissolution of metal at the root of the advancing crack." This is the classic type of failure, and it can be made to occur when the speciment is made the anode in an electrical circuit. But corrosion cracking also occurs when the specimen is made the cathode. This time, though, failure is by corrosion-induced delayed fracture.

As noted above, it's hard to distinguish between the two types visually. But NRL has found it possible to speed up the delayed fracture with an externally impressed current, so that failure occurs in a very short time. The same current, applied to an anodic specimen loaded at 50% of its (notched) tensile strength, has relatively little speedup effect. Specimens stand about 16 hours before failure. It's a positive, easily made test—and should be a real help in corrosion research. A.R.G.

Shock waves at 100,000 mph are created in this innocent-looking apparatus at Lockheed's Missile Systems Division. Known as a hydromagnetic shock tube, it uses magnetic fields to boost a high-voltage discharge to speeds in excess of Mach 150. Lockheed is one of the companies pioneering in magnetohydrodynamics (magneto fluid dynamics—interaction of highly ionized gases with magnetic fields—see Sept. 23, p. 17).



BRIEFS . . .

Russian research on metallography and the physics of metals is reported in a 475-page tome, just released by the AEC through the Office of Technical Services. It covers alloy transformations, vacuum melting, tracer studies. Price: $2.20.

Biggest atom-smasher, a 10-million-volt Van de Graaff, is nearing completion at High Voltage Engineering. It will be shipped to Atomic Energy of Canada, Ltd. Two others are on order for University of Wisconsin and Florida State. Cost: about $1 million.

Putting the alchemists to shame, Chicago atomic physicists and engineers have turned 77¢ worth of gold into $3000 worth of mercury. The mercury, of course, is very special—the man-made isotope 198, important because its fine, clear spectral lines provide a highly precise standard of measurement. Nuclear-Chicago Corp. did the job, on a project for Bell & Howell, with the cooperation of Argonne National Lab. Cost is explained by the time required for the job (irradiation alone took 10 months).

What's happening in MATERIALS

Stainless: progress on three fronts

In cast, wrought, and powdered form, stainless steel is moving ahead nicely.

Slip-cast, powdered stainless parts can now be produced in sizes as big as 12 in. across—bypassing the need for expensive compacting equipment that might otherwise boost cost of such parts far out of range (Sept. 23, '57, p. 6).

In wrought alloys, there are such new materials as Armco's precipitation-hardening PH 15-7 Mo, developed specifically for aircraft and missile construction, and reportedly able to stand the 1000-F heat developed by flight at Mach 4.

In cast alloys, perhaps the biggest news is no news: The stream of complaints from nuclear reactor builders about foundries' inability to meet specifications has died down to a trickle within the past few months—indicating that new, tougher standards can be met for all sorts of products.

There is news on the data front, too. The AEC and the Air Force have both released a number of reports on stainless steel through the Office of Technical Services, Department of Commerce, including one on a Russian symposium (AEC-tr-2924) with much basic data on high alloys as well as stainless steel.

Should you use tin?

Tin is still a strategic material, still supplied mainly by Malaya, still used to large extent (40% of production) for tin plate. Yet, behind this familiar story are some interesting new developments.

As the amount of tin used per unit of tin plate production has decreased, new electronic applications have appeared. Tin is used, for instance, in semiconductor devices for checking weight-of-fill and labeling on food processing machines. And the Malayan Tin Bureau says tin oxide films are under consideration for electroluminescent devices.

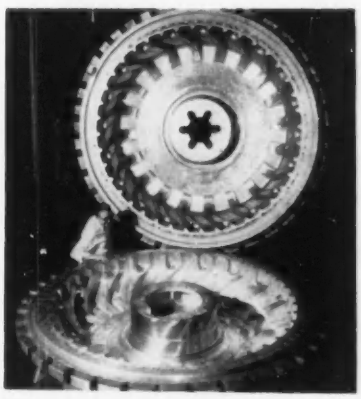
These applications, requiring relatively small amounts of tin, are fairly safe even in time of war. And, there may be a new and important tin source on this continent one of these days: Alaska. P. R. Holdsworth, Alaska Commissioner of Mines says: "There are distinct possibilities" that tin mines can be opened in Alaska, and the situation "certainly justifies extensive study."

Are plastics ready for a museum?

The Society of the Plastics Industry thinks maybe they are. It's circularizing its members to find out. First step might be a historical exhibit in conjunction with the next National Plastics Exposition (Nov. '58, in Chicago).

As the Society points out, plastics really aren't a brand-new class of materials anymore. The industry is celebrating its 90th anniversary this year. And even "new" families of plastics like polyethylene and the fluorocarbons date back to the early 40's.

Surprisingly, there seem to be few major museums devoted to materials as such. But the success of institutions like Corning's Museum of Glass indicates that there's room for more.



Cast aluminum parts can now be designed in sizes unheard of a few years ago. These tire mold back-up sections produced by Alcoa represent a new bench mark. They weigh over 7,500 lb apiece, are almost 9 ft dia, have a section thickness from 3½ to 10 in.

BRIEFS . . .

Prices of major materials have been remarkably stable for the past few weeks. Copper held firm through end of September, and there has been no change in other metals since early summer. Phenolic plastics and nitrocellulose are scheduled to go up, though—a cent or two a pound on November 1—and others may follow.

Use of welded aluminum and stainless steel is booming, if argon consumption figures are any index. Well over 50% of the gas is used for that purpose and consumption has ballooned from 55 million cu ft in 1951 to more than 300 million last year.

Another polyethylene plant, using a modification of the older, high-pressure process, will be built by National Petro-Chemicals Corp. in Houston. It will produce a material intermediate between the familiar high-pressure, low-density product and the new high-density resins made in "low-pressure" plants by catalytic processes. The plant is scheduled to go on-stream late in 1958, and to produce 75 million lb a year. It will bring National's total yearly capacity to 175 million lb.

Try this for electrical, abrasive products

Crystalline elemental boron, a hard, lustrous material now available commercially, has interesting electrical and abrasive product possibilities. U.S. Borax & Chemical Corp. is supplying it, and says that, unlike the amorphous boron previously available, the crystalline material is nonhygroscopic, and stable in air to at least 840 F. Its melting point is over 3600 F, and it has a strong, negative temperature coefficient of resistance; according to one research report, resistivity is 700,000 ohms at room temperature, less than 10 ohms at 930 F. Current price: $70 a lb (small quantities, $1 a gm).

Engineering's experience

Although many pages describe the activities of Theodore J. Kauffeld, M.E., P.E., Consulting Engineer, and his wholly-owned subsidiary, Devenco, Incorporated, they must inevitably be headed "a partial list of clients" or "a partial list of projects". His 600-man staff is engaged in a diversity of projects, including chemical, metal processing, and power plants, schools and industrial buildings. His organization also handles the development of related machinery and processes, together with many individual product-development programs. Among his clients are the U. S. Government and hundreds of leading corporations.

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FEATURES DIE CAST PANEL

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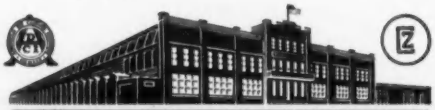
This remarkable panel is the result of thorough collaboration between Hammarlund and the die-making experts at Mt. Vernon, who made practical suggestions which simplified its design.

In addition to the production economies of die casting, the panel benefits from these other important advantages: (1) Die casting's inherent accuracy enables Hammarlund to assemble the chassis with what they call "camera precision construction." (2) All rejects on the production line are eliminated. (3) In finishing—die casting enables them to work out clearly divided areas for the elegant two-tone treatment that is both functional and beautiful. Also, the amount of finishing is minimized.

When you are out to break precedent, as Hammarlund did, you too can find the kind of skilled help you need in the complete service available from Mt. Vernon's coordinated designing, die-making, casting, and machining facilities, all under one roof, which can supply die cast zinc and aluminum parts ready for use. A switch to a die casting service like ours may be your next step. Let's discuss it.



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Product Engineering **HORIZONS**

it's what we do next that counts

We Americans were moonstruck last week. *Sputnik*, 185 pounds of space satellite, pushed Faubus and Little Rock off the front pages. No event since Welles' radio invasion by Martians has provoked more hysteria, more political haymaking, more charges and countercharges. Regardless of cost, the Soviet investment for *Sputnik* has already paid out in propaganda.

The satellite has only one practical value: It proves out years of calculation and conjecture; scientists the world over will learn tremendous lessons from it as the prototype for space flight. Far more important right now is the rocket that put it into its orbit; that rocket released man from the shackles of earth.

What's most important is what we, as a nation, do next. Eventually, we will shrug off, as we have before, the investigations, the yammering, the hysteria. Appropriations won't be changed much, *Sputnik* will become a political football, we'll go ahead with our own program. But will we remember the hard-earned lesson that the leader stays in the lead only by running faster than anybody else? Our present situation has been predicted for years, in warnings of Russian training of engineers and scientists, in single-minded concentration on goals that make a world impression, in ruthless direction of the national economy in a drive for world supremacy in technology, military and civil.

Let's put the whole problem into a familiar frame of reference: Your company and its biggest competitor both realize the need for new models. Management sets your objective as a new design selling for 15% less. But, while you're still hard at it, your competitor announces his new model—at 25% less.

What do you do next? You can cry that he had more help. You can belittle his new design. You can point out its weaknesses. You can devalue your product to sell for less. You can even throw up the sponge.

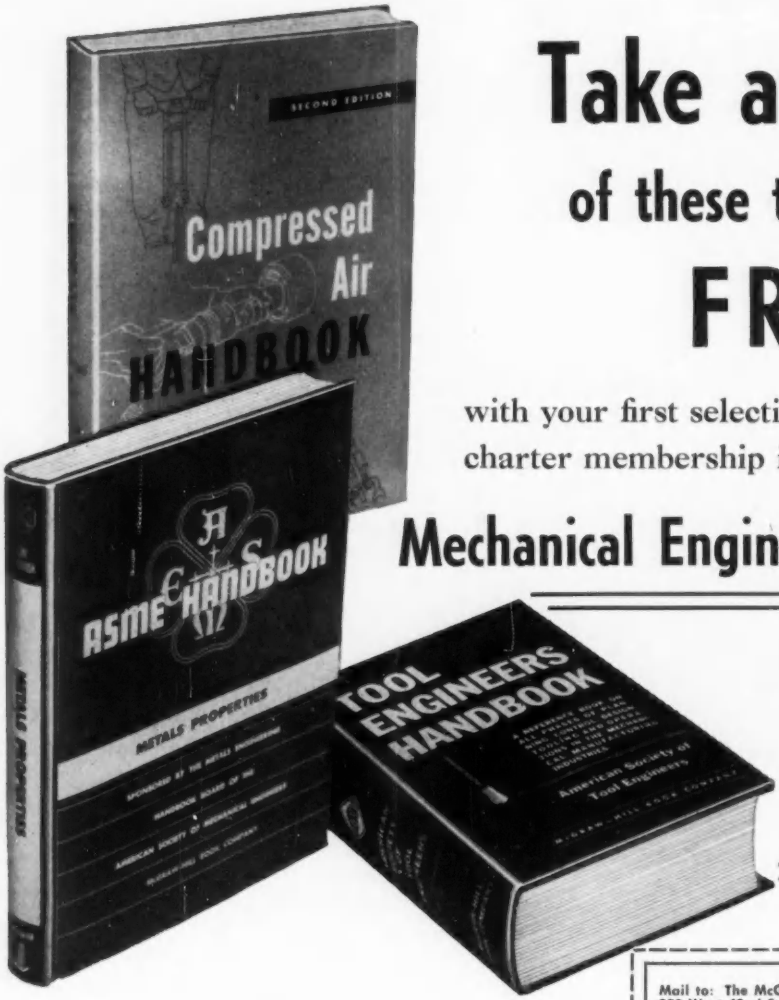
Not if you're smart. You redouble your efforts, check his design and recheck your own. Has he made a design breakthrough you didn't see? Has he found new materials, new processes? How can you overcome his weaknesses? How can you, make your ideas better than his?

Expand this to a national basis, and you have our present American position. It's high time for us to stop breast beating and to start "running scared." What materials, what design, what engineering went into that rocket? Were the Russians forced to a 185-lb satellite because they haven't advanced as far as we in miniaturization? Or is there more equipment within the satellite than we know? Will the *Jupiter* really take a satellite into an orbit? If so, did our multiple-agency, multiple-committee program hinder our doing it? Or was it lack of suitable tracking equipment? Do we need to concentrate our separate rocket programs into a single agency like the Manhattan Project. Can we stop the snafu that still holds up fiscal-'58 R & D funds?

Have we learned the lesson that supremacy in anything is the result of intelligent directed effort, not of bombast and propaganda? Can we prove our boast that free people can outthink, outplan and outproduce slaves?

It's what we do next that really counts.

K. Stangerman



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NEW PRODUCT TRENDS for the YEAR 2000

Research and Development Edition

NEW YORK—"Research is the insurance policy of the technological revolution," Dr. Henry J. Rand, (right) president of Rand Development Corp., told a special Research and Development Conference of the American Management Association here. And he illustrated his point by describing some products and materials that will probably be developed by the year 2000.

Freighting over long distances in that year will probably take a route through outer space, in ground-controlled, unmanned vehicles. This will call for developing new high-temperature materials. One source may be plastics. With their low heat conductivity, these materials will char but damage will be limited to the outer layers. This may make the plastic uniquely adaptable to applications in aircraft structural parts.

Dr. Rand revealed to *Product Engineering* that his firm is now working on a process to automate the manufacture of fiber glass and plastic parts, like boat hulls, truck and car bodies, containers. Key to this operation is a gun that simultaneously mixes the plastic with the catalyst, chops the glass rovings and deposits the mixture on the form.

When asked what fields were ripe for exploitation, Dr. Rand said that the railroad industry offered many opportunities. While television is now used to display the numbers on freight cars some distance away to the main control tower, there still is the writing step for the human to accomplish. The procedure should be to photograph the numbers and transmit them on tape to the control tower. Also, there is too much labor connected with the assembling and taking apart of the cars of any train. It costs as much to do this as it does to send the train 1000 miles.

Any job involving extensive paper work, such as banks and meter reading, can be simplified by machine work. Information is accumulating at such a fantastic rate that it is impossible to keep up with it, without the aid of various types of machines. The Patent Office and the Post Office are prime targets for any inventor who thinks he has a way to speed up such data handling.

OTHER PREDICTIONS MADE BY THIS R & D EXPERT:

Development of high strength as well as high-temperature plastics looks promising. In combination with fibers, plastics may ultimately be engineered to strengths capable of use as structural parts for bridges.

New techniques for applying heat and pressure to change the crystal structure of molecules, such as General Electric has used to create its diamonds and boron nitride, will probably lead to new families of materials which should contribute much to the art of grinding and polishing.

Investment in automatic tools for factory workers will rise at an "astronomical" rate. But automation will not be limited to the factory. It may reach its highest development in agriculture. The farmer of four decades from now may use computer and photo-sensing devices to program and control his traditional chores of plowing, sowing and reaping.

The chemical industry will probably advance as much in the next 40 years as it did in the last 40, and one of its major sources of raw materials may be the sea, which will be converted into hundreds of valuable materials. Rassweiler, Johns-Manville's vice president for research and development, said that developing new products is a three-fold problem. Research must first determine what is technically possible. Then Sales and Market Research must determine how to convert available technology into something a customer wants to buy.

Strategy for determining what specific product to develop must be based on a prediction of what the customer will want in five years. So management should know something about prejudices and plans of the potential customer, how he will use the product, and whether he has correctly defined the nature of his technical need.

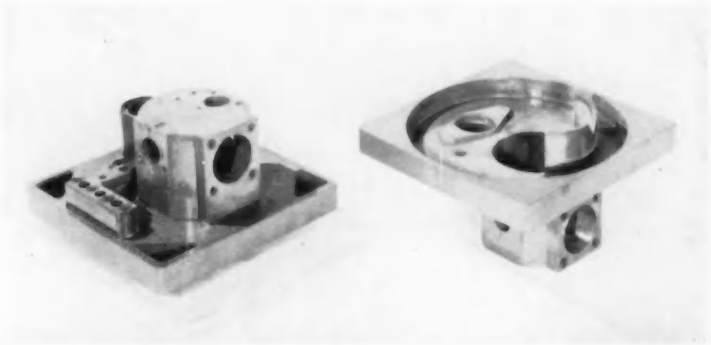
Third prong of the decision is whether the company has the ability to make and sell the product. This should include a long range plan for setting aside the capital needed for plant and equipment.

A rising ovation was given Dr. W. F. G. Swann, director of the Bartol Foundation of the Franklin Institute, for his discussion on creativity in the sciences. Dr. Swann had identified himself as one of the "pure" scientists who everybody today seems bent on "controlling and administering."

The engineer is essentially concerned with solving a problem so he can create something tangible, he said, and does so by combining what he understands with his intuitions derived from knowing the solution to an analogous problem. But as the engineer is called upon to solve increasingly complex problems, he must press his analogies too far, and his thinking about the problem bears less and less resemblence to nature. Dr. Swann warned that unless minds capable of extracting key relationships from the known facts are given freedom to think, they will fail to solve the problem.

Mr. Ralph Burgess, economist for American Cyanamid, cautioned that the size of a research budget must be determined by "informed, subjective" judgment; so many intangibles are involved that it is dangerous to bind company decisions by an equation, however logical.

There are times to say "no" to the sales staff, according to Dr. Roy C. Newton, v.p. in charge of Scientific Research Laboratories at Swift and Co. The technical director should say "no" when the sales department asks for a product that the technical director knows is impossible. He should also say "no" when it would cost a product its quality.



Most complicated molding yet made from rigid polyvinyl chloride, this part is also the heaviest. It contained 15 threaded metal inserts, weighs 14 lb. Custom-molded by Luzerne Rubber Co., Trenton, N. J., for use in a chlorination system, it will be displayed at 26th Exposition of Chemical Industries, Dec. 2-6 at New York City's Coliseum.

Faster than faster-than-sound plane, dark blobs are folding-fin aircraft rockets caught by high-speed camera during test firing of Convair F-102A "Delta Dagger" all-weather jet interceptor over Holloman Air Force Base, N. M. Full exhaust blast from salvo of 24 rockets blends into mass of flame as they start outdistancing the supersonic plane.

How to Set Up and Control R&D

Vital questions in handling research and development were explored in workshop sessions—13 of them technical; 15, distribution; and one combined—at the President's Conference on Technical and Distribution Research for the Benefit of Small Business in Washington, Sept. 23-25 (*PE*—Oct. 7, '57, p. 25). The questions themselves resulted from a survey in advance of the conference. Among technical workshop subjects, and conclusions drawn, are:

Training, recruiting, and motivating personnel . . . At least one man must be assigned to planning and programming—even though it may be the founder or president . . . R & D must be a top-management-based function . . . People must be retrained periodically, and management must be trained to handle R & D people . . . R & D men must be encouraged to become active in professional groups, to keep their interest and capability at top pitch . . . Small business has been successful in attracting suitable R & D people.

How to acquire, interpret and use technical information . . . Trade publications (indicated by surveys as the leading source), libraries, suppliers, big companies, trade associations, and government are sources, depending upon data needed . . . Unless people are particularly assigned to this responsiblity, valuable time will be wasted when a need arises, and the same search may be repeated.

How to use R & D to improve productivity, operations research, inspection, etc . . . Scientific research on these problems is very new, but can be extremely useful . . . R & D should be separated from other engineering activities—in another location if possible . . . Reports should be direct to top management.

How to communicate to management the value of R & D . . . Management is afraid of research—the risk, the cost, even the terminology. More objective data should be available on the value of research . . . A big need is for the ability to express what research is achieving in nontechnical terms. Perhaps professional public-relations advice is needed . . . Other needs are: better distribution of research data, problem-solving clinics run by college men, perhaps "county engineers" functioning for engineering as much as county agents function for agriculture.

How R & D activities fit into the over-all company . . . A small company must have the same R & D functions as a large one, although the structure will be simpler . . . Ideas must come from all over the company, R & D acting merely as collector, tester and arranger. There are four steps to

successful R & D: Idea gathering, screening, product development, and marketing . . . Management must interpret R & D to all company departments, must be sufficiently sensitive to the R & D program to do this well.

How to manage R & D projects . . . Use an all-department committee to suggest projects, not to control them . . . Don't make R & D a trouble-shooting operation for the sales department . . . Bet on a man, not on a program, and make him responsible . . . Methods and procedures should be simple, with goals in writing . . . Pooling for research is sound . . . Larger companies are pleased to help . . . Customer criticism is helpful . . . A local organization can be set up to coordinate and encourage R & D . . . The patent system needs refurbishing.

How to evaluate R & D ideas and suggestions . . . An evaluating committee, made up of representatives of all major operating divisions, is required . . . Check a new idea from these angles: technical feasibility, size of market, novelty, cost of development, cost of manufacturing, relationship to present lines and business, legal angles and liability . . . The Small Business Administration will help evaluate ideas after which it's up to company.

Purchasing, R&D Urged to Work Hand-in-Glove

LOS ANGELES–Procurement activities for research and development departments should be headquartered with R & D, but at least some of the purse strings should be held by a purchasing agent. Both engineers and purchasing agents agreed on this during a panel discussion at the annual conference of the Society of Automotive Engineers here. Extent of control, however, caused a difference of opinion.

Several companies have purchasing men attached to the R & D staff–men who buy prototype and small-lot items. Normal equipment and material needs go through central purchasing department channels, but purchasing special machinery for R & D allows immediate handling of items, eliminating red tape and long lead-times.

Other companies hoping to avoid lengthy purchasing procedures maintain well-stocked junk rooms. Still others work through unofficial and underground purchasing systems–frowneed upon, but a method that precludes stalling of R & D brain waves.

Most popular technique mentioned was permanent assignment of a purchasing agent to R & D. The purchasing agent places the call to the vendor for the engineer. The agent monitors the call but the engineer does most of the talking. The agent writes a report on conversation.

When the engineer must speak personally with the vendor, the purchasing agent sets up the entire trip, including travel and hotel reservations. The agent goes along to monitor conversation, and writes a report. After the engineer writes his recommendation, the agent compiles a requisition that the engineer approves or disapproves. If approved, the agent's letter is forwarded through a special purchasing channel for prompt action.

This same company makes certain no breakdown between vendor and engineer can occur. One engineer, in addition to other duties, is responsible for efficient communications–transmitting specifications and prints, and handling attendant paper work.

All at the panel agreed that procurement for R & D poses problems different from those of buying for production: limited quantities needed at a moment's notice make the purchasing agent's job ticklish.

Slipshod purchasing is of prime concern to government agencies because it can lead to inferior products, prolonged lead-time, expensive expediting and even terminated contracts. One Air force representative said, "The extent and scope of R & D procurement is definitely a matter of control by the procurement department of the company."

Consensus of panel members was that purchasing people should have at least some control over R & D buying and at all times be aware of what's going on.

Sputnik Proves Russians Have Best Rocket Engines, 1st Rate Guidance System

WASHINGTON–The Russian Sputnik has put its own special spin on Washington. The official military line –stemming from the President–is to play its implications down, that it has little military significance. Scientists on the other hand, consider it a major achievement. In between, there is a bloc of opinion that the Russian development has both military and scientific implications, that the two cannot be divorced.

The big question, whether the Russians are actually ahead of the U.S., is debatable. But this much seems evident from Sputnik: The Russians have a more powerful rocket vehicle than the U.S. To launch a 184-lb satellite means that the total weight of the satellite and rockets was likely around 50-80 tons. It compares with the total weight of the U.S. satellite that will only be around 10-tons. Our satellite itself only weighs some 21.5 lb.

It has been known for some time that the Russians have more powerful rocket engines than the U.S. For example, the Russian Intercontinental Ballistic Missile is supposed to be a two- or three-stage vehicle–each rocket being of nearly equal power. Our own Atlas ICBM reportedly has one major liquid-propellant engine, with 135,000lb of thrust and with two boosters of 100,000lb each.

You can get some idea of the difference in propulsion approaches by looking at the intermediate-range missiles–where more information is available. The Russian IRBM is powered by a first-stage rocket engine with 254,000lb thrust, and a second stage motor of 77,000lb. It has a range of 1,800 miles.

Our own Jupiter IRBM is a one-stage missile with an engine producing only 135,000lb of thrust. Its range is 1,500 miles.

Sputnik shows also that the Russians have developed first-rate guidance systems for rockets, evidenced by their ability to toss their satellite into an apparently optimum orbit. We hope that we will be able to put ours in about the same orbit.

Apparently the Russians have equalled or surpassed us in the use of liquid and solid fuels. Only time will tell what Sputnik signifies.

Europe's New Cars Stress Safety, Comfort but Price Hike Looms as Market Booms

FRANKFURT—European automobile designers, like their US counterparts, are aiming toward greater safety and comfort. This was apparent at the International Automobile Exhibition held here, with Germany as host.

After more than 800,000 persons visited the show, car manufacturers and accessory suppliers claimed enough orders to continue production at full capacity into the coming winter months—usually a seasonal slump period.

Gallup tests among the visitors indicated that demand for cars will increase considerably in years to come. Owners of small cars are ready for medium-sized vehicles. Drivers of 2-wheel vehicles want a roof over their heads.

But a price increase is indicated. Thin-metal-plate makers reportedly intend to raise prices soon. Added evidence is new wage demands of workers in metalworking, and the recently effective price hike on coal.

Foreign interest at the show ran high, the success of German automotive vehicles abroad leading to decisions by other European nations to expand their German service organizations. It follows that Germany's export quota may exceed even the current 50% of total production.

Safety measures include the usual good engine, reliable brakes, and good road-holding ability. But they also include more comfortable seats, clear instrument boards, and automatic clutches. Such features, according to a Daimler-Benz engineer, keep the driver from tiring and therefore contribute to safety.

Most new models on display were in the baby car class—those with engines designed for 48 to 660-cc displacement. Burgeoning customer interest in this type car is encouraging an increasing number of German manufacturers to enter the field. The market is made up largely of Germans who have owned motorcycles and motor scooters, but are now ready for small cars.

The market for baby cars now supplied by several manufacturers has not yet become large enough to make mass techniques feasible. Price tags on the cars in Germany are therefore generally higher than on mass-produced vehicles like the Volkswagen. To most Germans, however, operating costs, rather than initial price, determine choice of car. Their low fuel consumption, low road taxes, and insurance rates are giving the baby cars growing consumer appeal.

In the medium-size category, Opel Rekord (slated for export to the US this year) attracted wide attention. It has been criticized for poor road-holding characteristics. To overcome this, new models have expanded wheel base and lower center of gravity.

The trend toward comfort also dominated heavy vehicles. Pneumatic springs, at least for rear axles, have been added to many trucks as well as busses. Other design trends included lower weight, self-supporting construction, and maneuverability.

Europe Approaches U. S. in Machine-Tool Efficiency

HANNOVER, GERMANY—European machine-tool builders are fast closing the gap between designs of the US. This was noticeable at the Fifth European Tool Exhibition held here last month. (see p10)

The show drew some 960 exhibitors who spread their wares over nearly 1 million sq ft of floor space. Experts agreed unanimously that the 1957 display far surpassed the preceding four in size and scope.

Proof that Europe is catching up is the increased horsepower of its machines (though the US is still tops), and production automation—with more flexibility resulting from this automatic operation.

Though US builders were excluded because European machines can't be displayed in the US, many American-designed machines, in particular those built by the British, were on display. Also, many American representatives, men from Ford and GM, attended the show as observers.

Program control has been applied to a limited number of machines, such as Switzerland's SIP jig borer-millers, Britain's Newall jig borer-millers, Belgium's Progres lathes and Germany's Heller millers.

A new SIP machine has a memory unit for repetitive work, and can use punched cards. Newell uses dial setting or punched cards with BTH equipment. Many other machines exhibited here had a limited form of program control and automatic cycling, with pushbutton and other methods of presenting the cycle.

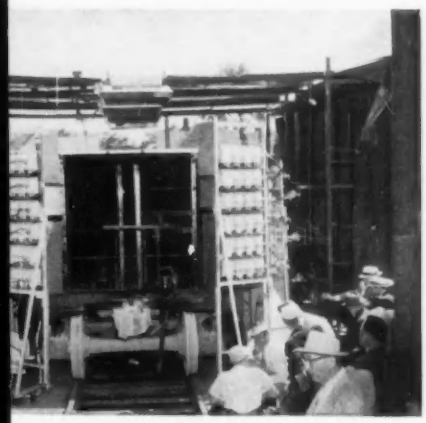
Punched-tape control by Britain's EMI Electronics on a Cincinnati hydrotel was one of the few punched-tape units at the show. It made the machine impressively flexible. "Perforated tape" control also was used on a new French GSP twin-spindle machine for jig drilling, boring, tapping and milling. Germany's Schiess had punchboard control for one of its large vertical boring millers. It used the Brown Boveri control unit. Germany's Spandau automatic internal grinder was an example of automatic loading and unloading of work, but would be of limited application in European shops.

Except for Switzerland's George Fischer machine using ceramic tools there was small evidence of much effort put into ceramic devices. An exception is Germany's Muller electromatic lathe with spindle speed up to 5000 rpm, allowing constant cutting speed up to 2400 fpm; this machine appears to have application for ceramic tools.

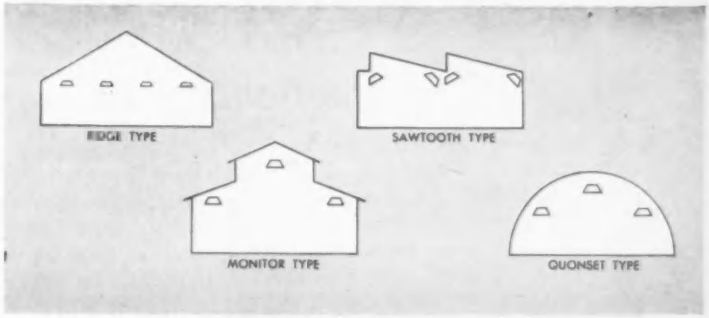
Germany's Lorenz has a new gear hobber with circular table loading that cuts two gears in one cluster. Diagonal hobbing displayed by Germany's Pfauter provided for the hob to proceed not only with axial feed parallel to the work but tangentially in the direction of the axis of the hob.

Britain's Heenan and Froude exhibited a strip-forming machine (up to 1¼ in.) to demonstrate application of all-hydraulic operation and control, also evident in Germany's Ravensburg surfacing lathe with hydraulic copying equipment.

Ceramic Mat Turns Fuel Gas into Infrared Heating



Frozen iron ore filling the rail car was thawed in minutes by the two banks of infrared heaters seen in this demonstration.



Mounting arrangements for Schwank generators are determined by type of building, as shown here. Where building structure, machinery placement, cranes, or height limitations prevent overhead placement, units can be mounted at angle from wall.

CLEVELAND–A new use for infrared rays has been developed by Perfection Industries, Div. of Hupp Corp. Fueled by gas, ceramic-mat infrared generators based on research by German scientist Guenther Schwank and manufactured here under license agreements, are being installed in such high-bay buildings as foundries, warehouses, and aircraft hangars. Recently, too, the heaters were employed to thaw frozen iron ore quickly in a test-demonstration rail car (see photo).

According to C. H. Foulds, Perfection vice-president, the Schwank generator differs markedly from previous gas infrared heaters. It bypasses one stage; the ceramic units both support combustion and act as the infrared emitters, with no metal strips or louvers needed. Higher operating temperatures are feasible and a maximum proportion of the Btu input is converted to usable infrared.

Gas combustion takes place on the surface of a patented ceramic mat perforated with 200 holes per sq in. for passing the air-gas feed mixture. The large number of holes and physical characteristics of the ceramic make possible the relatively high surface temperature achieved–operating temperature can reach 1650 F. Because gas is converted to infrared energy in the wavelengths readily absorbed by most common materials, the generator is claimed to be the most efficient known today.

The heating unit works with natural, manufactured, or liquefied petroleum gas–metered through an orifice, passed through air-aspirating chamber and mixing tube to a chamber under the ceramic mat, where it is distributed uniformly through the ceramic. No pre-mix or blower is necessary because the system is a 100% primary air burner. US-designed generators based on the Schwank principle are multiples of an eight-ceramic combination called a "rayhead." These are grouped in an aluminum reflector that helps direct infrared toward the surfaces to be heated. For installations in high-bay buildings, a large number of rayheads are combined in the same fixture to radiate over a large area.

DEFENSE CUTS – BUT ENGINEER SHORTAGE REMAINS

WASHINGTON–The Department of Labor has stepped into the debate with its side of the story–there is, too, a shortage of engineering and scientific help, and this despite recent defense cutbacks.

James T. O'Connell, Under-Secretary of Labor, went before the President's Committee on Scientists and Engineers to notify the group that his department still considers these manpower fields to be short.

"We want to state clearly and emphatically," he declared, "that over the long run the number of scientists, engineers, and technicians needed will continue to increase rapidly. There is danger that public misapprehension as to the employment situation in science and engineering will create apathy that would defect our attempts to meet the nation's long-range needs for scientific and technical personnel."

Surveys made by the Labor Department show some areas around the country–Tucson and Phoenix, for example–will need from 50 to 100% more technical personnel by 1961 than they presently employ.

But O'Connell admits the Department doesn't know what the nationwide need will be for this period. In fact, one spokesman for the Department admits it doesn't know how many engineers there are in the US today, and says privately that a key factor in the situation is to determine just what the needs will be and how many graduates the colleges will be turning out in years ahead.

Despite assurances by the government that the technical manpower field remains in short supply, there is other thinking around the country that the military cutbacks will affect the job market. Companies are scaling down the number of June graduates they will be needing. This comes at a time when there is a push by industry and colleges alike to curtail some of the wooing tactics in past years to obtain new graduates.

Engineers Called On to Control Rising Maintenance Costs

NEW YORK–Reliability isn't the whole story. Engineers must design systems that are also easily and cheaply maintained, Dr. D. P. Barnhard, Deputy Assistant Secretary of Defense for Research and Engineering, said in an address to the National Security Industrial Association here.

As an example he cited statistics on the rising number of maintenance men and man-hours of labor required to keep modern warplanes operational.

The F-51 World War II fighter required 12 to 15 man-hr upkeep per hour of flight. The F-102, its present counterpart, demands 45 man-hr.

The F-94 fighter of Korean vintage needed 266 technicians per squadrom –25 of them electronic specialists. The F-102 requires 414 technicians per squadron–77 of them in electronics. That's a three-fold increase in electronics personnel.

Dr. Barnhard stressed these points:

Easy maintenance must be an integral part of design, and the military value of weapons is closely linked to it; it is sometimes difficult for an engineer to keep his eye on this objective because he "becomes engrossed in the solution of a complex problem." Design approach to simpler maintenance will very probably take the form of more modular construction and increased use of throw-away elements.

A view of long-range budget policy and the role industry will play in design and production in the period ahead was given at the meeting by W. H. McNeil, Assistant Secretary of the Department of Defense.

The avowed goal of the Department for some time, he said, has been to maintain spending at a high but steady rate for as long as the international situation requires U.S. military preparedness.

During the last half of fiscal '56–January through June '57–defense spending unexpectedly leaped from an annual rate of $37 to $40 billion. Mr. McNeil cited this precipitous increase as incompatible with the goal of a spending plateau, and other objectives of the government–a public works program to provide schools and roads, and a balanced budget to make room for tax reductions. Probably all necessary cutbacks have been made, he explained, but the Department will not be certain until it tallies all of its expenditures for September and October.

Mr. McNeil said one factor behind the spending surge is increased cost of R & D and production–an inevitable corollary of the push for hotter weapons such as aircraft that will operate at greater speeds. Holding the budget line permanently will probably mean cutting military personnel and facilities to continue steady development and production of new weapon concepts whose costs are presently skyrocketing.

He predicted the Department will push toward better timing in phasing-in new weapons, to reduce overlapping of old, intermediate and new systems; also, that Department policy will probably support fewer product planning programs which represent parallel approaches to a single problem.

Ford Motor Set To Open $150,000,000 Research Center

DEARBORN, MICH.—Ford Motor Company's new research and engineering center, scheduled for completion in 1958, will be the largest single design facility in the automotive industry. Costing $150 million, the new center will cover 760 acres, provide 3,700,000 sq ft of floor space and consist of 19 major structures.

Building was started in 1947 as a memorial to the late Henry and Edsel Ford with the original engineering administration building serving as the hub for center activities. The administration building that Henry Ford used as his headquarters for more than two decades has been enlarged by 50%.

Other buildings include the new dynamometer building where car performance and durability will be evaluated, a new fuel building, a new styling building, a new industrial relations building, a new pilot gas turbine building, a new scientific lab and research building and a new maintenance building.

Also new buildings for body engineering, for a cafeteria, for staff and product engineering, for new vehicles and for a wind tunnel. In addition, four older buildings have been refurnished or enlarged, while test track facilities have been modernized.

Ford's new center exceeds GM's research and technical center in size and cost, the latter having completed a $100 million center two years ago.

Accepting First Entries for Miniaturization Test

KEENE, N. H.–An eight-man committee has been appointed to administer a Miniaturization Award, an annual competition established this year to stimulate further activity within industry toward advancement of the concept of miniaturization.

According to Horace D. Gilbert, president of Miniature Precision Bearings, Inc., sponsor of the award. the following will serve as committee members: R. I. Goetzenberger, educational consultant, Minneapolis-Honeywell Regulator, Co.; Dr. George H. Lee, director of research, Rensselaer Polytechnic Institute; Gerard Piel, editor, Scientific American; Gustave Shapiro, chief of Engineering Electronic Section, Electricity and Electronics Div., National Bureau of Standards; George F. Sullivan, editor, The Iron Age; E. J. Tangerman, editor, PRODUCT ENGINEERING; Arthur W. Weber, vice president, engineering and manufacturing, Corning Glass Works; and Mr. Gilbert.

In order to qualify for consideration, entries must relate to a contribution to miniaturization that was accomplished during the recent past, and not years ago. No deadline for entries has been scheduled yet.

Companies, organizations or individuals competing for the award should outline their contributions to the concept of miniaturization, submitting their entries to the Awards Committee, Miniature Precision Bearings, Inc., Precision Park, Keene, N. H. Entries are now being accepted preparatory to judging for the first award.

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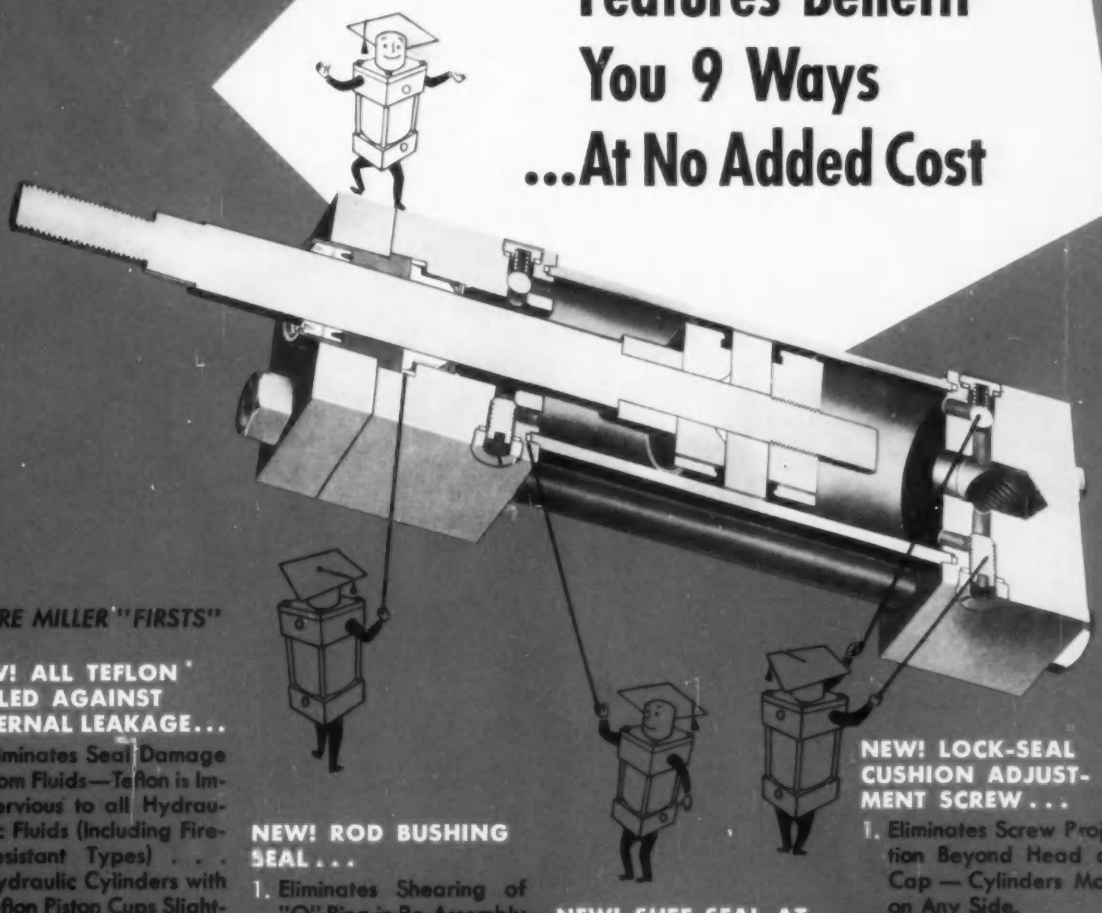

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- Interchangeable Square Design

Miller — FLUID POWER DIVISION
FLICK-REEDY CORPORATION
2002-04 N. Hawthorne Ave., Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

Announces a New Space and Price Saving Hydraulic Cylinder Line

MORE MILLER "FIRSTS"

SAVE UP TO 76% OF COST

Heavy Duty Model LH—Same Size As Ordinary Gasket Type Square Design Low Pressure Cylinders			
BORE	NORMAL RATINGS	NON-SHOCK INTERMITTENT RATINGS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

Announces 50% More Power Per Cylinder Dollar

with Extra Heavy Duty

3000-5000 PSI MODEL H

HYDRAULIC CYLINDERS

Same Price and Mounting Dimensions as Miller 2000-3000 PSI Hydraulic Cylinders.

BOTH LINES MADE POSSIBLE BY SHEF SEAL

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FLICK-REEDY CORPORATION

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

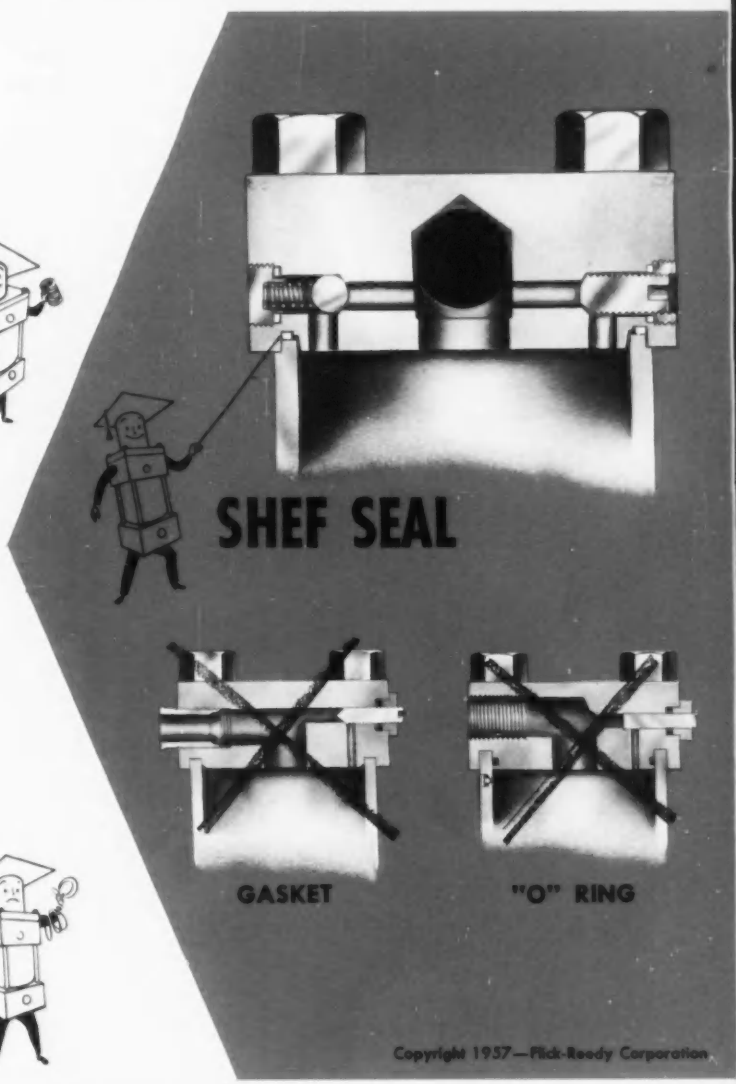
OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

SHEF SEAL Obsoletes All Other Hydraulic Cylinder End Seals . . . *at no added cost*

HAS EVERY ADVANTAGE

1. Pressure Energized—Sealing Effectiveness Increased with Pressure.
2. Zero Metal-To-Metal Clearance at all Pressures Gives You Perfect Seal Backup. Sealing Ring Cannot Extrude.
3. Simplified Servicing. No "Blind" Assembly. Sealing Ring Cannot Shear.
4. Teflon* Sealing Ring Withstands All Hydraulic Fluids at Temperatures from —100° F. to 500° F.
5. Head and Cap Axial Movement Does Not Destroy Sealing.
6. Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
7. One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
8. Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.



NONE OF THESE DISADVANTAGES

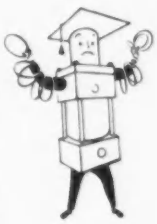
GASKET CONSTRUCTION

1. Unpredictable Results—Leaks and Blows Even at Low Pressures.
2. Outlawed by J.I.C. Eight Years Ago.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.

"O" RING CONSTRUCTION

1. High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
2. Blind Assembly Can Shear Sealing Ring—Difficult Servicing.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
4. Requires Large Inventory of "O" Rings
   —For Servicing Variety of Cylinder Bores.
   —For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.

*du Pont trademark for its tetrafluoroethylene resin.



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When you buy Miller ... You buy extra years of worry-free Cylinder performance ...at competitive prices

SHEF SEAL—*Another Miller "First"*

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
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- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

Miller — FLUID POWER DIVISION
FLICK-REEDY CORPORATION

Turn Page For More About MILLER

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

All Teflon Sealed —Perfect Sealing for Hydraulic Cylinders

HAS EVERY ADVANTAGE...

Teflon—As Static and Dynamic Seals

1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
2. Seals Perfectly in Cylinders at Temperatures from —100° F. to 500° F.
3. Can Be Molded Into Shapes That Have Zero Leakage—Hold Pressure Indefinitely.
4. With Proper Design of External Seal Cavities, Teflon Can Be Included *Without* Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

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•du Pont trademark for its tetrafluoroethylene resin.

When you buy Miller
You buy extra years
of worry-free
Cylinder performance
...at competitive prices

NONE OF THESE DISADVANTAGES

Synthetic Rubber— As Static and Dynamic Seals

1. Unsatisfactory Except When Used With A Limited Range of Hydraulic Fluids.
2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
4. Normal Temperature Range Limited to 0° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Greatly Reduced Life at 150° F. to 250° F.
5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

Resin Impregnated Leather— As Dynamic Seals Only

1. Is Compatible with Many—But Not All—Hydraulic Fluids and Additives Including a few Fire-Resistant Types.
2. Normal Temperature Range Limited to —60° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Substantially Reduced Life at 150° F. to 250° F.
3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
   Miller Uses Leather Piston Cup Seals for Internal Sealing... Standard Price (Teflon Cups Extra).

Piston Rings— As Dynamic Internal Seals

1. Most Piston Rings Allow Some Leakage.
2. Allow "Slip" or "Drift" of Piston Due To Leakage—Unsatisfactory for Many Applications.
3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup—Unsatisfactory for Most Multiple and Automated Operations.
4. Allow Some Pressure Loss.
5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring —Especially During Startup.

All Teflon Sealed—*Another Miller "First"*

OTHER MILLER QUALITY FEATURES

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S SHEAR PROOF
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PAT. APPLIED FOR

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AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

To preserve the fruits of industrial research . . .

Dr. Guy Suits, Director of Research of General Electric, warned last month at the conclusion of his address before the President's Conference on Technical and Distribution Research for the Benefit of Small Business, "We must re-emphasize the correlation between technological advances and a rising standard of living . . . several things need to be done to insure continuation of the benefits of industrial research:

1 . . . Build Technical Manpower

"First, and foremost, we must assure the nation an adequate supply of technical manpower. Working with schools, we businessmen can take an active role in encouraging young people to further their studies, and to explore their technical aptitudes and interests. We can awaken students to future opportunities, provide tangible career-guidance material, help teachers become even more effective, and provide financial assistance to schools and colleges, including that of helping our employes repay their alma maters. Within our own companies—regardless of size—we can give our men and women opportunities to acquire new skills, encourage them to continue their education by establishing cooperative programs with nearby schools and colleges, and provide opportunities for professional training and development.

2 . . . Rejuvenate the Patent System

"Second, to insure continuation of the benefits of research—particularly to small business—we must rejuvenate our patent system. There is need for a more sympathetic attitude on the part of the courts toward the original concepts and philosophy upon which the patent system is based. We must recognize that the inventor who provides previously unknown ideas, machines, and processes definitely contributes to progress. There also is need for improving the facilities of the Patent Office for determining whether submitted inventions are new or old. The Patent Office threatens to be overwhelmed by its inability to accumulate, classify, and search—as its responsibilites require—the growing mass of technical literature, including its own, within a reasonable time.

3 . . . Stimulate Technical Advance

"Third, we must develop new ideas about scientific advances and how they are produced. We need greater understanding of scientific and technical specialization and their relationship to team effort. We must recognize, in our developing management concepts, the basic character of creative technical work, and must provide the incentives which are needed to stimulate productive effort.

4 . . . Explain the Profit Motive

"Fourth, we must create a better understanding of the necessary relationship between profits and progress. Research is a high-risk business profits give us the opportunity to maintain the cycle of technological progress: research—new products—jobs—sales—and the profits that permit the cycle to start again. We must reaffirm to people everywhere the basic American belief that profit as a foundation stone to free enterprise is an integral element of the growth of our nation and our society.

5 . . . Overcome Resistance to Change

"Fifth, we must create a greater understanding on the part of management and employes, of the significance of new processes and new products. The human trait of 'resistance to change' has kept people in some parts of the world literally in the Dark Ages. Obviously, not everything new is necessarily good, nor do all products of modern research yield immediate improvements. However, it is essential that we all contribute to an atmosphere in which new things can be evaluated objectively, without fear of changes simply because they are changes.

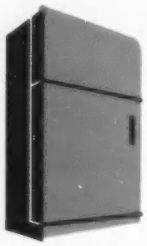
6 . . . Make Research Profitable

"Sixth, with research and innovation assuming such a tremendously important role in the nation's economy, these elements should most certainly be kept within the framework of the free-enterprise system. American industry, large and small, must play an appropriately aggressive role in exploring, developing, appraising and utilizing new technology through research and development. Even in the national-defense area, private industry would be willing to finance a greater proportion of the needed research and development—if the procurement policies were to provide the same profit incentives that over the years have been so magnificently productive in the civilian economy.

7 . . . Work Together

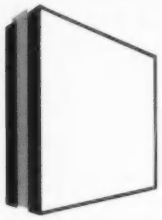
"Seventh, we must establish a climate of informed public opinion which recognizes the political and economic conditions necessary for encouraging the expansion of industrial technology.

"The public must recognize the significance of industrial research and its basic importance. Big companies and small each have an essential role to play, appropriate to their resources, to their special skills and capabilities, and to their initiative. The management of all American industry must recognize the importance of supporting the kind of fundamental science that provides us with basic new understanding about the world in which we live. And business, large and small, must recognize and share in the opportunities created by the technological revolution—bringing it benefits to the public—each company doing what it can do best, and each drawing strength from the other."



Thermal insulation

Urethane foams can help you improve the design and cut production costs of products or components requiring low temperature insulation. Lower K factor, higher structural strength and self-adhesion to flat or irregular surfaces make them an ideal thermal insulation and structural material for: *food containers, piping and process equipment.*



Acoustical insulation

Low density urethane foams have excellent sound *absorption* qualities. Higher density foams effectively reduce sound *transmission.* Foam formulations and application techniques can be varied to give you the exact acoustical (and thermal) properties you require. Typical applications include: *automotive heater duct assemblies* and *sandwich panel constructions.*

Vibration dampening

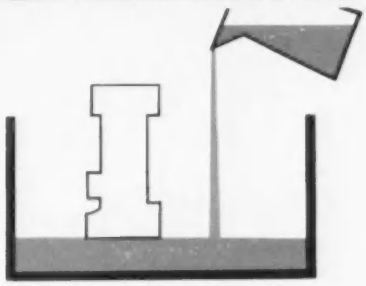
Vibration is another problem which urethane foams can help you solve. They effectively dampen vibration of components or structural members with a minimum of added weight. Design engineers can now combat premature failure of parts due to shock or flex fatigue in such applications as: *transportation, air conditioning* and *electrical equipment.*

Now, foam-in-place to insulate, ...with URETHANE FOAMS

Whether your design problems require a material for structural reinforcement, thermal, sound or vibration insulation, formulators of urethane foaming compositions can *now* supply you with liquid two-part systems that offer all the many unique properties of either a rigid or semi-rigid urethane foam. These systems, customized to meet your particular requirements, can be foamed-in-place without added heat or pressure—in densities from 2 to 20 lbs./cu. ft.—to fill even the most complex cavities. The foams "self-adhere" to most surfaces while foaming. They have K factors as low as .21. Their cell structures are controllable. They offer *you* new opportunities for product design and development./*HYLENE is Du Pont's trademark for its organic isocyanates—key urethane foam ingredients. Mail coupon today for details.

TYPICAL PROPERTIES OF URETHANE FOAMS

PROPERTY	Density of Foam (per. cu. ft.) 2 lb.	10 lb.	20 lb.
Adhesion (bond strength, psi)			
to glass	9	50	142
to steel	12	62	146
to wood	17	62	170
Compressive Strength at 75° F. (lb./sq. in at 50% deflection)	10	290	—
Flame Resistance	Can be formulated to be self-extinguishing when flame is removed; burns only in direct contact with flame.		
Flexural Strength (lb./sq. in. at 75° F.)	10	275	750
Sound Absorption Coefficient (@ 500 cycles/sec.)	0.99	0.22	—
Temperature Range	to 250° F.	to 250° F.	to 250° F.
Thermal Conductivity at 75° F. (K Factor—BTU/hr./sq.ft./in./°F.)	0.21	0.24	0.32
Moisture Absorption—lbs. per cu. ft. (120 hours at 98% rel. hum.)	0.38	—	0.56



Foaming in place
from a liquid stage *without added heat or pressure* is an important advantage of urethane foams. They will expand and solidify in the confining area of any cavity; form a tight bond to most surfaces while foaming. Complicated molds can be filled completely without expensive fittings or fabrication. Structural reinforcing can be simplified by foam-filled "sandwich" panels using thinner primary surface materials.

absorb sound, dampen vibration made with Du Pont HYLENE*

Write for our new, free booklet describing the properties and uses of urethane foams.

URETHANE FOAMS
made with DU PONT HYLENE

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. PEH-10
Wilmington 98, Delaware

☐ Please send me a copy of your free booklet, "Rigid and Semi-Rigid Urethane Foam."

☐ Please send me a list of foaming composition suppliers.

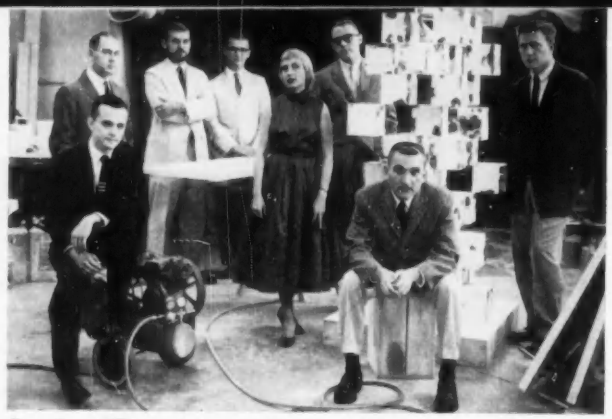
☐ I'm interested in urethane foams for possible application in

Name _____ *Title* _____

Firm _____

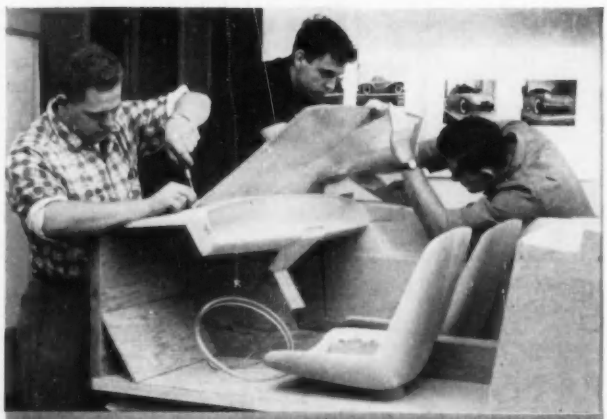
Address _____

City _____ *State* _____



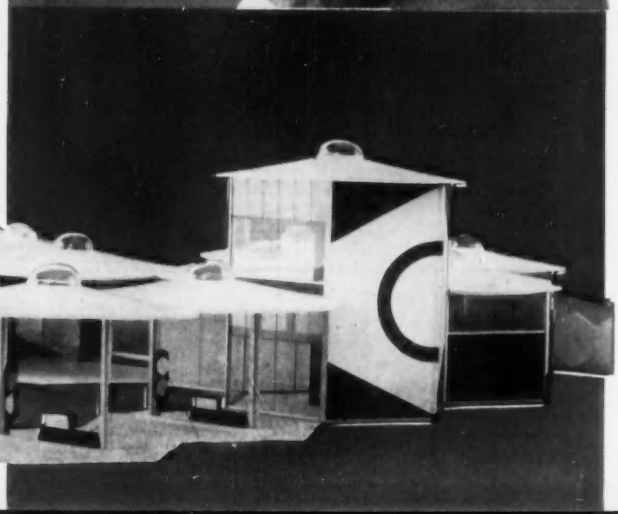
Student-exhibit design committee, representing Univ. of Illinois, Syracuse Univ., Rhode Island School of Design, Pratt Institute, Philadelphia Museum School of Art, Univ. of Bridgeport, Institute of Design (Illinois Tech), U.C.L.A.

YOUNG AMERICA



Hand drill

Tape recorder



Service station

DAVE CHAPMAN, F.A.S.I.D.
President, Design Research, Inc., Chicago

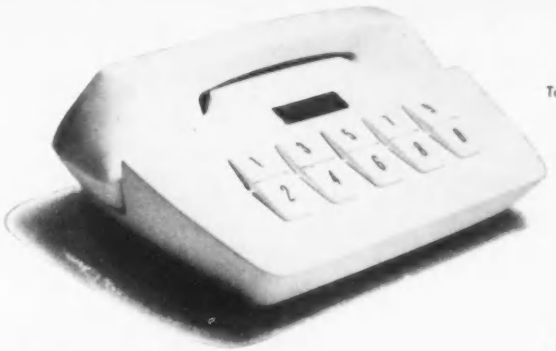
Early this month I had an opportunity to preview an exhibit of the work of industrial design students from eight leading American design schools. The show titled "Industrial Design Education/USA," was displayed at the Institute of Design, Illinois Institute of Technology, before being sent on foreign tour under the auspices of the US Information Service.

Several weeks previously I had attended the Triennale in Milan, Italy. There I saw recorded the accomplishments and direction of industrial designers, artists and craftsmen throughout the world.

It is no accident that I should parallel my comments on these two exhibits, one by experienced professionals and the other by youngsters striving to find their places. The Triennale displays what has already been done; the student exhibit expresses what may be accomplished in the decade ahead.

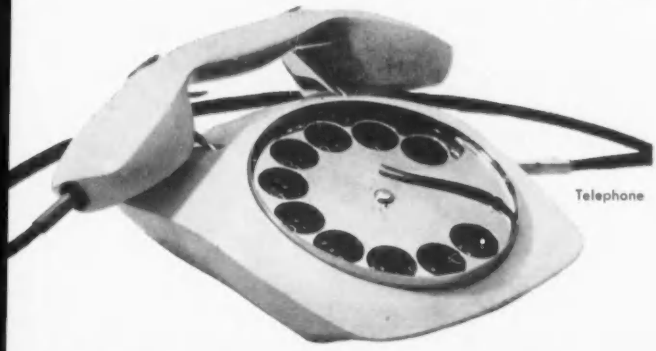
These young designers drive home a significant message to all of us. In the preparation of their drawings and models the students were not restricted by engineering considerations, production techniques and merchandising patterns. Therefore, we might have expected that their youth would be demonstrated in startling and impractical designs. Instead, the material shown was astonishingly realistic and gratifyingly mature.

A moral may be drawn: If all of us invest more of our energies (and budgets) in areas of creative development, with fewer restrictions than we now normally impose, we can look forward to exciting new products, to new market horizons, in the years ahead.



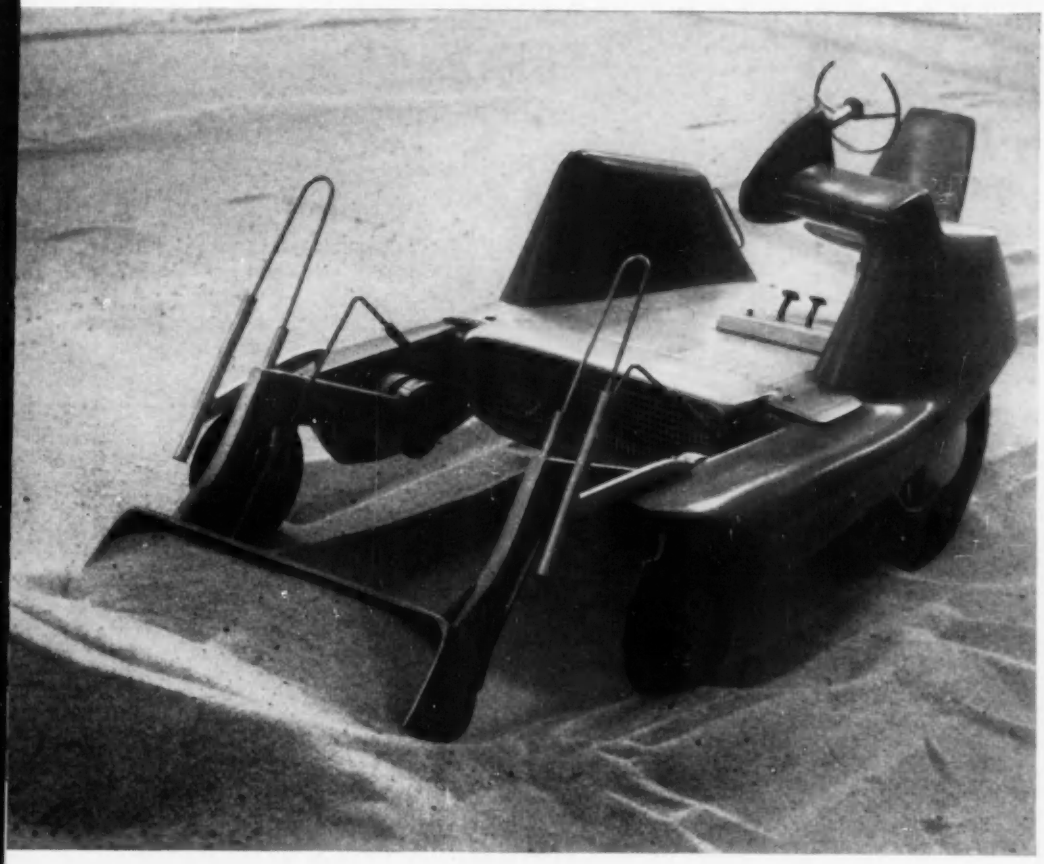
Telephone

DESIGNS



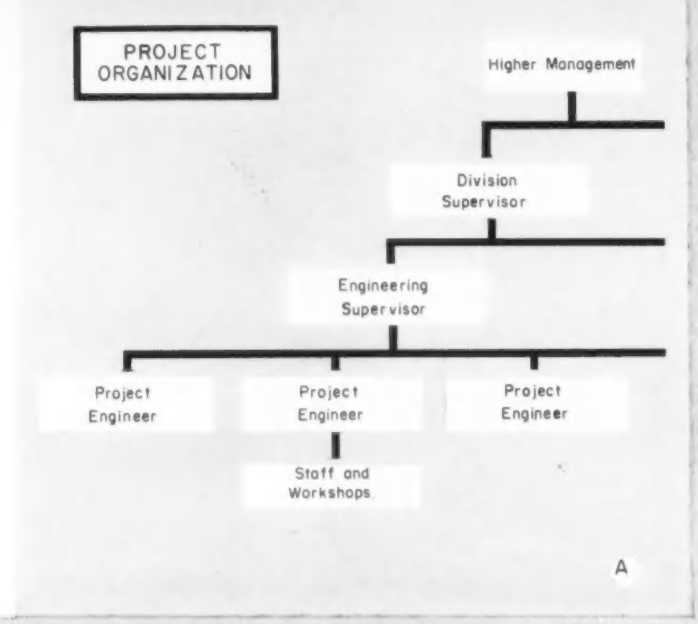
Telephone

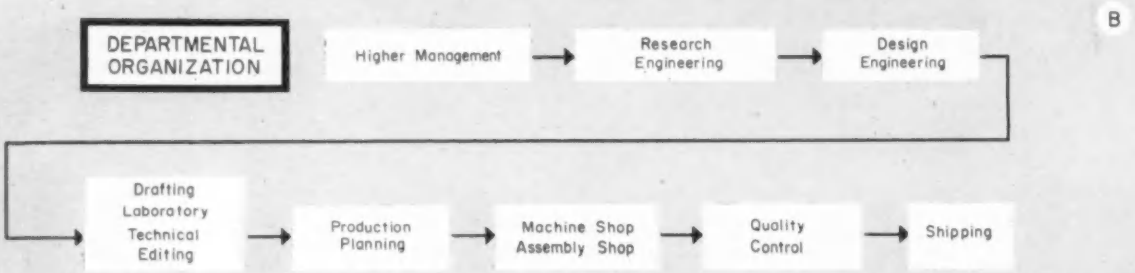
Desk Chair



Farm tractor

BEST SETUP FOR R&D





T. W. JARMIE

President, Engineered Electronics Company

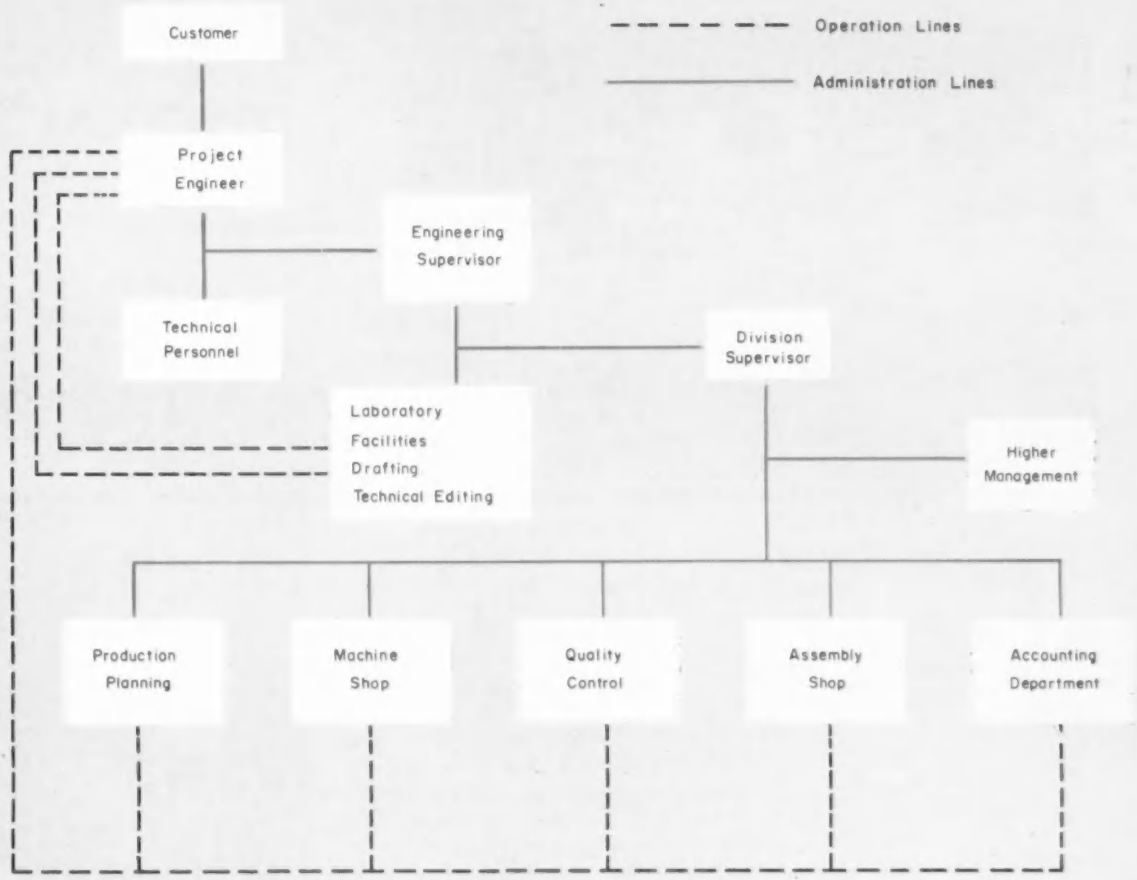
Most research and development companies do not mass-produce their products. Usually their customers require just a few custom-designed products—or maybe only one. Engineering time, therefore, accounts for much of the final cost. Anything done to use engineers more efficiently will thus affect final costs far more than for a mass-produced article.

A major source of inefficiency can be the way operations in the company are organized. The Service Organization described here should not be regarded as just another operations chart. A genuine change of mental attitude is required. It assumes that the real "boss" is the customer, who rules through the contract or purchase order. The project engineer, once he is chosen to work with and for the customer, must be given the utmost freedom to get the project completed. All other departments should be regarded as services upon which the project engineer can call for assistance. For example, his supervisor controls central pools of test equipment, space and other facilities that can be directed as necessary within the company to the main end of getting the project completed efficiently. The division supervisor can supply more project support, where necessary, such as production planning, over-all material control and accounting functions. Priority questions can be referred by the project engineer to his own supervisor. If project operations can be rescheduled the problem goes no further. If not, the division supervisor may be able to reschedule operations of other departments.

The operating departments must also look upon themselves as service functions. Their work is not an end in itself; its purpose is to produce a good product.

Project Organization

Faults	Advantages
1. Develops "Jacks of all trades."	1. Consistent supervision.
2. Excessive load on project engineer.	2. One learning period.
3. Nonstandard product.	3. No loss of data (one information source).
4. Inconsistent operating policies	4. Minimum Writing of instructions
5. Multiple outside representation.	
6. Duplication of facilities	
7. Inefficient use of personnel	



Both basic types . . . (opposite page)

(A) Project organization and (B) Departmental organization tend to be inflexible. They are bound more by "policy" than the idea of getting a job done efficiently and satisfying the customer. Justification for an action is often of more concern than whether the action furthers the end. Often, when he is promoted, an engineer is required to do less actual engineering and more administration. Engineering skill can, thus, even become a barrier to promotion—a good engineer is difficult to replace.

Departmental Organization

Advantages	Faults
1. Permits specialization.	1. Multiple supervision.
2. Distributes workload.	2. Increased writing of instructions.
3. Produces standard product.	3. Multiple learning.
4. Consistent outside representation.	4. Loss of data.
5. Consistent outside representation.	
6. No duplication of facilities.	
7. More efficient use of people (because of specialization)	

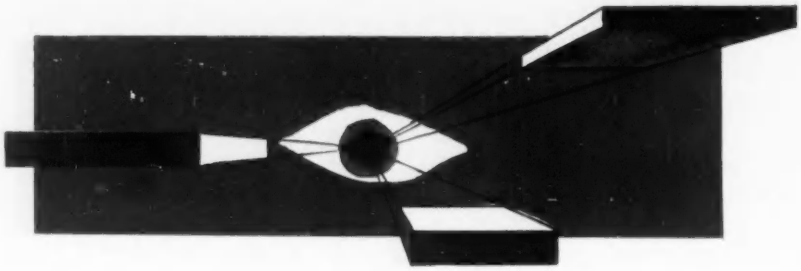
ORGANIZATION

Service Organization . . . ▲

joins together the good points of other types of organization, and has added advantages as well. To the engineer it gives; opportunity to advance with a minimum administrative burden and dilution of effort, opportunity in his junior days to learn by handling small projects or portions of large projects, opportunity to become acquainted with and be an important part of the over-all company picture—as a project engineer he is, and must be regarded as, an important member of the management team. It gives the customer ease of contact, ability to obtain decisions and information quickly and reliably, excellent relations, lower cost resulting from a higher efficiency. It gives vendors easy access to technical information without losing the security of a central purchasing decision. It gives the company flexibility, speed of action, ability to establish a standard of quality, appearance, and design philosophy, a cost situation which is more than competitive, ability to utilize the technical ability it possesses, ability to provide incentive and opportunity for individual progress and growth, ability to diversify its effort readily.

◀ Advantages are combined . . .

when two basic types become a service organization. Faults of the two do not occur in the third, which is based on the fact that the customer is "boss." Lip service is frequently paid to this dictum but, in practice, no real effort is made to re-arrange company structure so that the customer is boss. Switching to the service type not only combines existing advantages but gains extra ones.



POINTS

THE QUESTION:

How Has Standardization Affected the Design of Your Products?

JAMES ROBINSON
Director of Engineering
Machinery Hydraulics Div.
Vickers Inc.

"For the past 27 years . . .

Vickers Hydraulic Product designs have been influenced strongly by the desirability of standardization when accomplished with no sacrifice in performance. The original V104 vane type pump, for example, was produced in four distinct pump output sizes through interchange of only two sizes of certain parts. Vickers' present product lines, particularly for industrial machinery applications, are in many cases designed in 'families.'

"Not only does standardization simplify tooling, purchasing and production stocking for the manufacturer, but equally important it simplifies and reduces parts stocking costs for customers who use more than one type of a basic unit.

"While our own experience points up strongly the advantages of considering standardization in the design stages of a product, it should also be pointed out that too much stress on standarization is inclined to lead to stagnation, and is not conducive to development of original ideas. Like many other considerations, standardization should be used as a guide, not a noose."

RALPH E. CROSS
Executive Vice-President
The Cross Company
Detroit, Mich

"Component standardization . . .

plays an extremely important part in the development of Cross automated machinery. As a matter of fact, standard components, or machine 'building blocks,' are the key to the success of our business. With them, we are able to build virtually thousands of different kinds of machines for a wide variety of products, such as automobiles, aircraft, refrigerators, appliances, railroad cars, and business machines.

"We standardize because: it is the direct approach toward the reduction of engineering and construction costs; repeated experience with standard units contributes to the reliability of cross machine tools; standardization simplifies maintenance and reduces downtime—an important requirement for high-production machine tools; the time required to fill an order is greatly reduced; each machine built contributes to the successful design of the next machine; and new design ideas can be introduced in an orderly manner."

OF VIEW

"Standardizations in designs . . .

can have terrific impact on inventories, manufacturing costs, and more prompt shipments. This sort of standardization is only justified where enough experience has been obtained to establish all the requirements that the field may demand. The designer then sets out to meet as many of these needs as possible with standardized configurations, components and materials so that the advantages resulting from quantity production, repetitive manufacture without additional engineering time, and greater use of fewer parts will provide maximum inventory turnover and lowest manufacturing costs.

"While such a program of standardization will require a greater investment in engineering design time, initially, and perhaps even basically a somewhat higher unit cost than a tailored unit for each application, this will be more offset by savings in those 'hidden' costs resulting when a diversified line is necessary to satisfy a market demand."

GEORGE HABACH
Vice-President, Engineering
Worthington Corp.

H. O. KRON
Chief Engineer
Philadelphia Gearworks, Inc.

"As a member company of AGMA . . .

we follow its standards, and proportion our drives so that loads, stresses and deflections are within the limits set by the standards. This often dictates the physical size of a unit required to transmit a given horsepower. However, these standards are broad enough to allow latitude for the ingenuity of designers to conceive individual products.

"It has been necessary to redesign a complete line of gear units every few years, to remain in line with the latest standards. This means using improved materials, heat treatments, stronger shafts and bearings with more capacity. All this results in a final product more compact and of greater capacity than before."

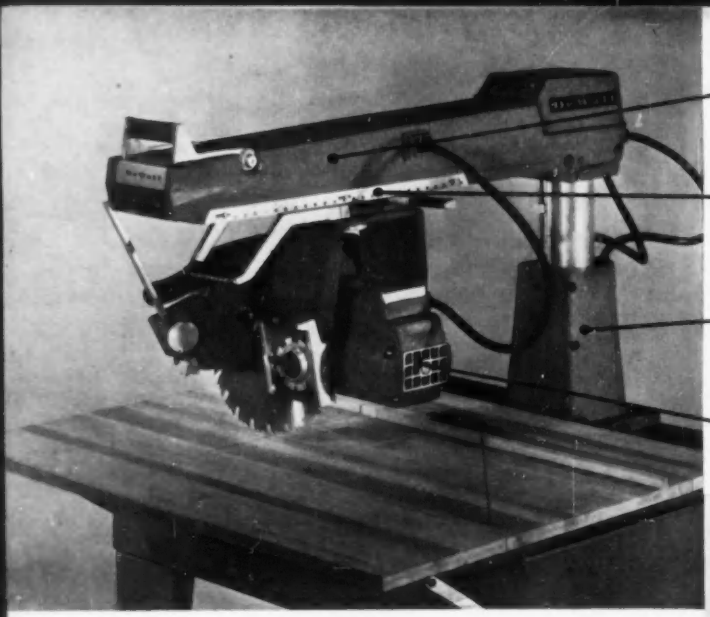
"Design details of bearings . . .

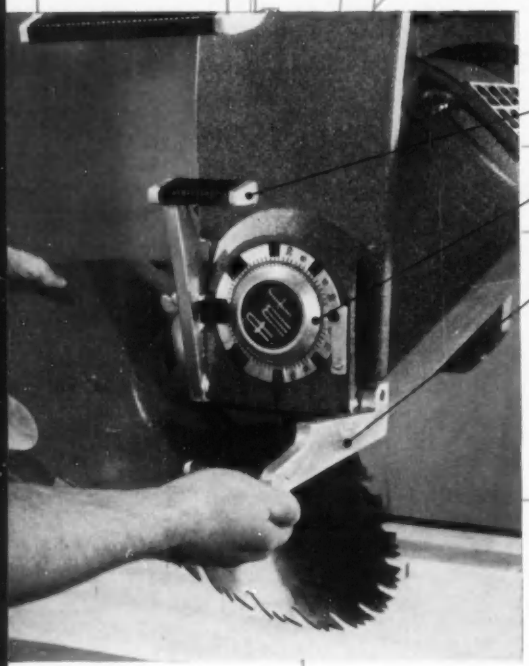
are largely dictated by the requirements of our customers. However, we have been able to standardize materials and manufacturing techniques to a large extent. The present trend toward standardization in industry as a whole has allowed use to cut down on the number of 'specials'. We feel that if we make known to designers, through our district engineers and home office staff, the dimensions and operating characteristics of our standard bearings, they will be able to consider them early enough in their design work to permit their use.

"This not only allows the customer to realize the improved availability and cost savings made possible by large volume production, but also insures that the envelope dimensions will allow the optimum internal design for the best bearing performance."

R. H. WHITE
Chief Engineer Bearings Div.
Torrington Co.

TRENDS



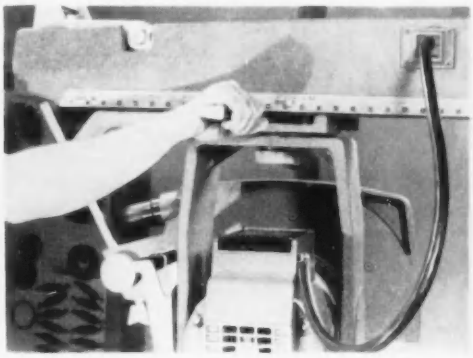


Controls and indicators have been brought forward and centralized in this redesigned DeWalt radial-arm saw with simple, square lines that ease cleaning. Power elevation speeds operation and lessens operator fatigue. A longer and larger column base adds rigidity and increase max rise to 16⅞ in. Emergency stop bar can be actuated by simple pressure of any part of body. Styling consultant for the De Walt, Inc. (subsidiary, American Machine & Foundry Co.) saw was Peter Muller Munk Associates, Pittsburgh.

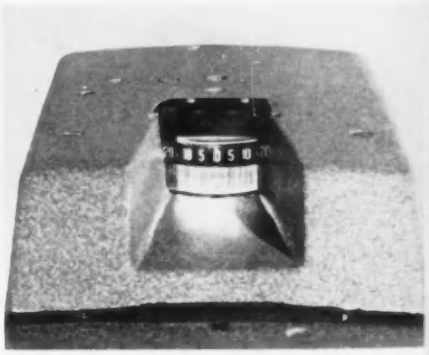
1	**Arm** —	The 7-in.-wide arm encloses all miter, yoke and electrical controls.
2	**Rip Scales** —	Dual rip scales permit adjustment from either side of the arm.
3	**Base** —	Improved base has increased rigidity, encloses power-elevation mechanism.
4	**Motor** —	New motor housing and terminal box contains all electrical components.
5	**Elevating Scale** —	Direct reading and adjustable for blade and table variations.
6	**Operating Handle** —	Provides improved operator control—handle does not swivel with motor.
7	**Bevel Latch Handle** —	Indexes the blade at zero, 45° and 90°.
8	**Bevel Protractor** —	Design permits rapid setting of blade at desired angle.
9	**Bevel Clamp Handle** —	Clamps blade at setting; large-lever arm provides increased locking action.

n appearance design...

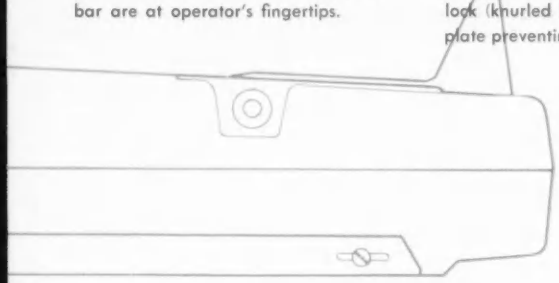
Relocated miter-angle control handle, power elevation, and emergency stop bar are at operator's fingertips.



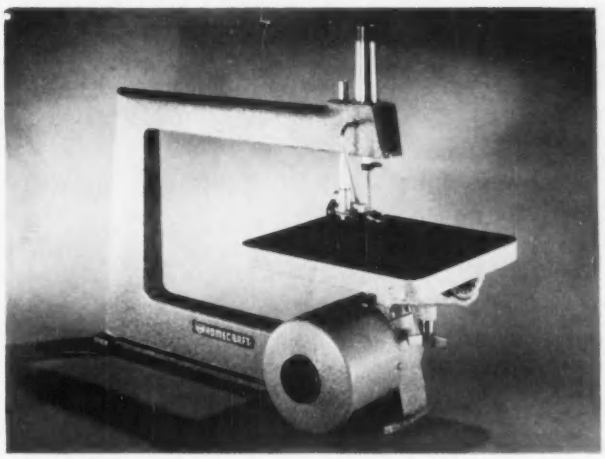
Indexing and clamping are now combined in single yoke control (in operator's hand); rip lock (knurled knob in yoke) clamps on separate plate preventing damage to enclosed roller tracks.

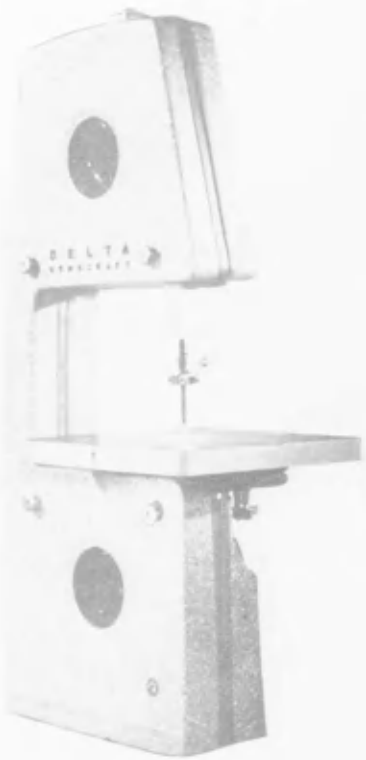


Miter protractor is backlighted through magnifying lens to provide large, easily read, single-degree scale.



Large one-piece casting of restyled band and scroll saw improve appearance and simplify cleaning. Mottled-gray stain-proof finish blends with lines of these power tools. Drive pulleys are enclosed for safety; clear work areas are provided by locating controls beneath the work surface. Built-in air pump keeps cutting area of scroll saw free of chips and saw dust during operation. Both saws manufactured by Delta Power Tool Div., Rockwell Mfg. Co.



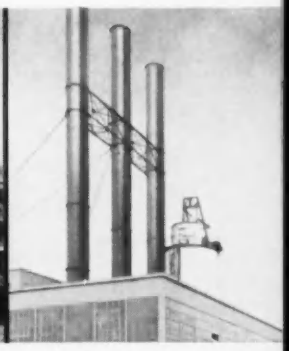


How we work steel to make steel work for you

TODAY, A. O. Smith *Permaglas* water heaters, proved in more than 3,500,000 homes, set new standards of life expectancy.

TODAY, *Permaglas* offers the best in 4-season air conditioning — with ceramic-coated heat exchangers promoting efficiency.

TODAY, A. O. Smith *Harvestores* revolutionize farm feed processing; *Permaglas* mechanized storage solves industry's bulk materials-handling problems.



TODAY, the high cost of smokestack rust-thru is being solved by *Permaglas* stacks that shrug off condensate corrosion.

YOU OUGHT TO KNOW ABOUT

glass-protected steel

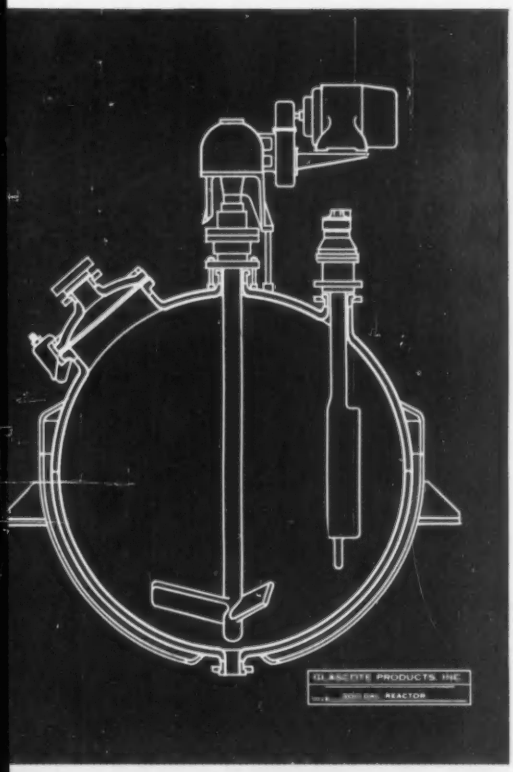
Today's products forecast tomorrow's promise; the possibilities are infinite

The world's most useful metal acquired vital new dimensions since A. O. Smith perfected methods for protecting steel with glass.

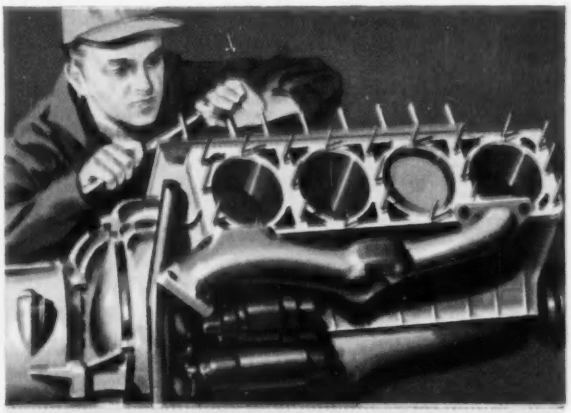
New dimensions indeed! With an inventory of more than 3000 glass formulations, A. O. Smith can produce coatings for steel that shrug off all kinds of corrosive attack . . . solve problems involving abrasion, contamination and catalytic action. The marriage of glass and steel is a permanent fusion bond — won't separate until the yield point of the metal itself has been exceeded.

Now available to all industry, A. O. Smith's specialized resources are being used by many manufacturers, planning for the future with glass-protected steel.

TOMORROW, the aircraft that fly at speeds beyond any known today will quite possibly wear slick, insulating outercoats of glass. Purpose — to reduce the heat produced by air friction (what airmen call the thermal barrier). This too is a research project inspired by A. O. Smith's unique ability to protect steel with glass.



NOW, approved for production at A. O. Smith's *Glascote* subsidiary — world's first spherical, glass-lined chemical processing reactor. Designed for severe corrosive service, the unit withstands far higher operating pressures than conventional cylindrical designs.



TOMORROW, the engine of your car may well have cylinder walls and piston rings lined with glass. Just one of the creative possibilities being studied by industry today.

TOMORROW, farmers may turn the earth with plowshares of glass-protected steel. The anti-abrasive character of A. O. Smith glass coatings could well be the answer to the problem of wear and tear in agricultural implements.

A. O. Smith is the world's largest manufacturer of glass-protected steel products. Want more facts about our own glass-coated lines? Or, about our ability to produce for you? Write for free Bulletin No. I-20.

Through research A.O. Smith *... a better way*

A.O.Smith

CORPORATION

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International Division: Milwaukee 1, Wisconsin

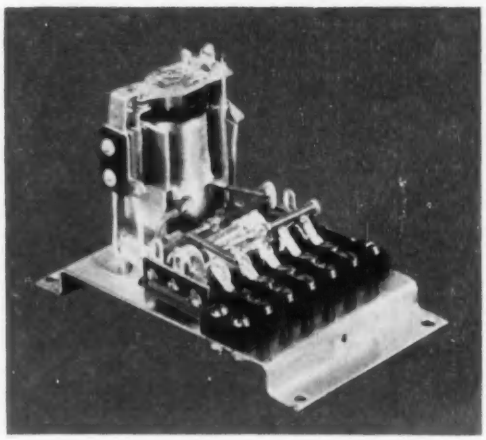
SIGNIFICANT PARTS

Heat-resistant butyl . . .

rubber will withstand sustained temperature of 400 F and 700 F for shorter periods. This material is presently being used for conveyor belts, hose, and a variety of molded products including gaskets, seals, diaphragms. Price: slightly above other butyl compounds. **United States Rubber Co., 1230 Ave. of Americas, New York 20.**

Sintered titanium parts . . .

such as bearings, cams, gears, filters and standard shapes are being produced directly from powder—instead of from pressed powder preforms. Ultimate tensile strength is around 65,000 psi; elongation, 10%. Uniformity of these properties part-to-part is good, and development of alloys of titanium is underway. This process provides a rather economical way of producing titanium parts; delivery schedules are about the same as for parts made of other metal powders by this supplier. **Keystone Carbon Co., St. Mary's, Penna.**



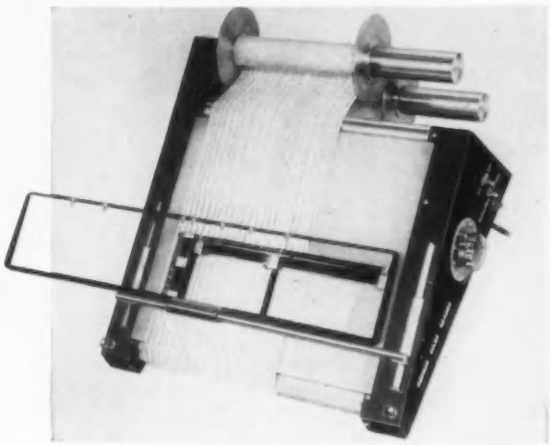
Over-under speed control . . .

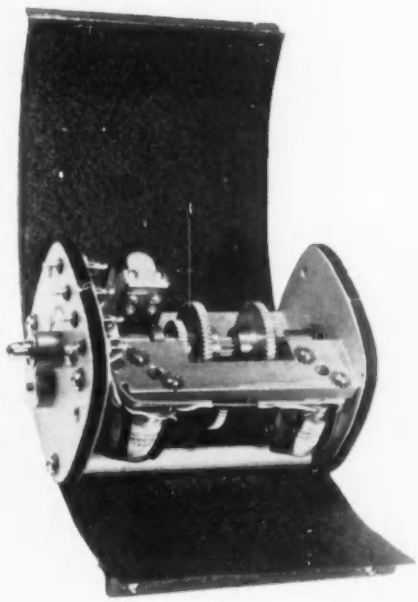
consists of a relay and the magnet-coil assembly that actuates it. No external source of power is required, because the magnet coil acts as a generator when placed near the teeth of a revolving gear. Excessive speed causes the relay to close, cutting off power, tripping an alarm or causing some other regulatory action. Critical speed for the control is set by adjusting spacing between magnetic pickup and actuating component. Relay is rated at 5 amp, noninductive load. Standard model, $24.50, model with magnetic amplifier $75; both available from stock. **Electro Products Laboratories, Inc., 4500 N. Ravenswood Ave., Chicago 40.**

MATERIALS · EQUIPMENT

Oscillogram scanner . . .

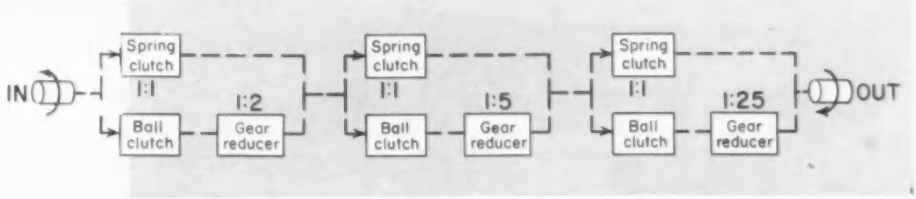
based on x-y reading system can handle any number of linear or nonlinear information channels—as many as can be recorded with oscillograph equipment on paper up to 16 in. wide. The reader will correct for either linear or nonlinear scale factors, and has a horizontal variable scale that can be set for zero location of any channel, with markers for individual reference line location. Vertical variable scale counts cycles, reads frequencies. Speed is adjustable, with instant-stop brake motor. Unit has automatic roll tensioning, is backlighted and operates on 110 v, 60 cps, 125 w. Price, about $1700; available from stock. **Gerber Scientific Instrument Co., 162 State St., Hartford 3, Conn.**





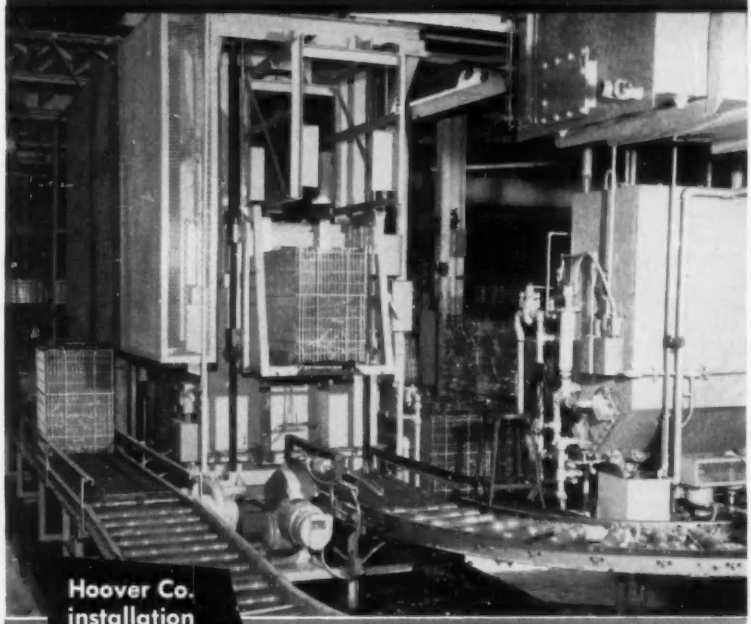
Light-load, variable transmission . . .

originally developed for driving instruments, is 4⅛ x 3½ in. dia, complete except for switch contacts to actuate its relays. With no relays actuated, the drive is straight through, 1:1. Actuation of one or more of the three relays releases helical-spring clutches, permitting ball clutches to lock-in and drive their respective gear trains. Various combinations of the three reductions (2:1, 5:1, 25:1) produce eight speeds. Max continuous-duty torque is 20 in.-oz at all speeds; max input speed, 1800 rpm. Note wraparound cover. Available from stock in quantities to about 200. Priced at $295 each. **Brush Electronics Co., 3405 Perkins Ave., Cleveland 14.**



AUTOMATION BY DETREX

means minimum maintenance



Hoover Co. installation pays for itself in 10 months

Gravity-roller conveyors move work to and from cleaning chambers. Hydraulically-powered elevator and indexing equipment moves work into and through cleaning chambers.

The automated solvent degreasing installation at The Hoover Company, North Canton, Ohio, clearly demonstrates the advantages of DETREX-designed metal cleaning and processing equipment.

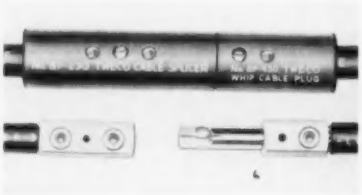
- Reduces "down-time" for maintenance by eliminating chains and sprockets inside the cleaning chamber.
- Requires less floor space and ceiling height because of compactness of conveyor system.
- Provides more uniform uninterrupted cleaning cycles for a greater variety of parts.
- Reduces solvent consumption through increased over-all efficiency of automatic installation.
- Eliminates manual loading and unloading of degreaser and reduction in necessary supervision.

Check the advancements provided by DETREX automation. You'll see why DETREX, pioneer in metal cleaning and processing, is the leader in the field. DETREX can recommend and engineer the right combination of chemicals, equipment and services to fill your specific requirements. Write today for detailed information.

DETREX CHEMICAL INDUSTRIES, INC.

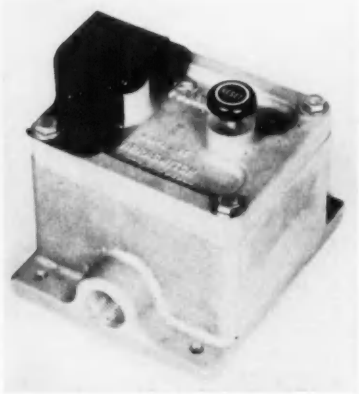
BOX 501, DETROIT 32, MICHIGAN

SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Electrical cable plug . . .

has a 300-amp, continuous-duty rating (600-amp on welding, for which it was designed). Splicer section is attached to lead cable by ball-point screws driven by a hex wrench. Plug section is attached to its cable in the same way. Parts are connected by inserting plug into open end of splicer. Another ball-point screw is driven into concave hollow in plug, which is covered with heavy-wall fiber sleeve. **Tweco Products, Inc., P. O. Box 666, Wichita 1, Kan.**



Low-sensitivity vibration detector . . .

protects rotating equipment when excessive vibration develops, and has a range of 0 to 4.5 G. Supplied in an explosion-proof housing, suitable for Class I, Group D; Class II, Groups F and G hazardous applications. The device is available with an SPDT switch, and a split-contact, normally open switch. Both are rated at 7 amp, 460 v ac. Adjusting sensitivity and resetting the device can be done without opening the housing. A tamper-proof guard also is provided. **Robertshaw-Fulton Controls Co., 2920 N. 4th St., Philadelphia 33.**

Punched-card reader . . .

accepts an IBM or any other standard punched card having as many as 80 vertical

columns with 12 punching positions each. As card is put in reading slot, rollers automatically place it in reading position. A signal light indicates the unit is "sensing" the card. An SPDT switch automatically activates associated control equipment. When card is no longer needed, it is ejected either manually or automatically. Four bottom-plate configurations are available; top plate has up to 960 electrically insulated connecting points. Reading-unit dimensions are 15 x 16 x 6 in.; weight is 36 lb; operates on 110 v, 60 cps. **Peerless Electric Co., Warren, Ohio.**

Electrical connectors . . .

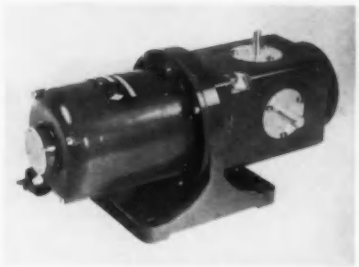
mount directly through knock-out or threaded holes in wiring boxes, panels and ducts, or on small motors and electrically driven hand tools. Available with two, three or four contacts, for 8-through-20-amp applications at a 600-v max rating. Receptacles are made up of two parts: a threaded, aluminum mounting shell, and a molded, one-piece, neoprene-insulated insert with pigtail wiring leads. Plugs are permanently molded to cable as one-piece insulated units. **Dept. 0-65, Joy Mfg. Co., 1201 Macklind Ave., St. Louis 10.**

Family of plastic foams . . .

includes two principal types: Formula 132 is a coarse, sponge-like structure with density of 2 lb per cu ft; formula 508 has uniformly fine cell structure and average density of 2.7 lb per cu ft. These densities, as well as color, structure and other characteristics can be varied to specifications, within broad limits. Shapes and blocks are available in thicknesses to 10 in., widths to 72 in., lengths to 40 ft. Sheets can be cut to size or supplied in rolls up to 72 in. wide, 30 to 60-ft lengths, thicknesses of $\frac{1}{8}$ in. and up. **Plastics Div., Curtiss-Wright Corp., 50 Rockefeller Plaza, New York 20.**

Shuttle valve . . .

is designed to prevent air from valve under actuation being vented to atmosphere through exhaust ports of non-actuated valves. The shuttle valve was developed to charge or discharge pressure cylinders in hydraulic or pneumatic systems. Such cylinders may then be actuated by any one of two or more three-way valves, located at remote control points. Valve is available in $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$-in. NPT sizes. **Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.**



Speed is infinitely variable . . .

from zero to full speed forward or reverse with this 3 in. square gearbox-and-motor combination. Can be used for either manual or automatic control, and low input requirement (2-3 in.-oz, ± 15°) makes it possible to use this system with solenoid or torque motor systems. Response time for full speed forward to full reverse is said to be less than 0.05 sec. Available with motors rated 1/50 to 1/10 hp. **Humphrey, Inc., 2805 Canon St. San Diego 6, Calif.**

Vibration mountings . . .

made of flexible elastomer are said to operate efficiently from −65 to 300 F. Transmissibility at resonance is 3 or less at 68 F; at 300 F it is less than 3.5. **Lord Mfg. Co., 1635 W. 12th St., Erie, Penna.**

• *A good chair is like a good wife...if you choose with care, it will look after your comfort and aid you in your work for a long time to come*

Cramer CHAIRS ARE

GOOD CHAIRS

Scientifically planned to aid YOU in your work . . . designed to support you comfortably whether you're chewing your pencil or bent over hard at work . . . engineered from the quality materials YOU would recommend, with independently adjustable seat, back and footring to conform to your physique . . . and with removable, replaceable covers in a wide range of fabrics and colors to match YOUR decorating plan.

Pictured, Cramer Hi-Model 4D-22T with forward-tilt seat; others available. All are low-gravity balanced for safe use on casters if desired.

LIKE MORE INFORMATION?

Cramer Posture Chair Co., Inc., Dept. PE-107
1205 Charlotte, Kansas City 6, Mo.

Please send me complete facts on the Cramer Hi-Model chairs designed for working architects and engineers.

Name _____

Firm _____

Address _____

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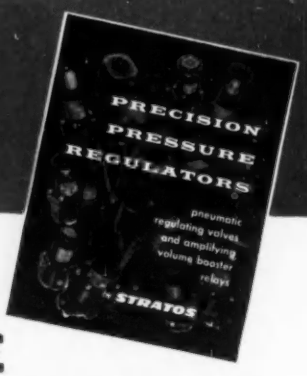

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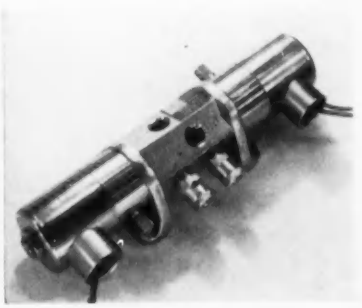
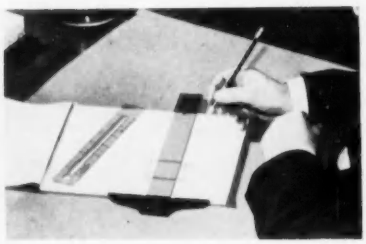
A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Air valve is manually controllable . . .

when the electric system is not functioning, permitting easier adjustment during setup. This is accomplished by twist-type manual actuators. The valves, available in single and double-solenoid models, are full-pressure piloted and come in ⅛ to ½-in. sizes for use with air or other noncorrosive gas. **Beckett-Harcum Co., Wilmington, Ohio.**



Small T-square . . .

can be used directly against the edge of a letter-size pad of paper, solving the problem of making small drawings, sketches and plans, without a drawing board. Instrument may be carried in a brief case. **Dolgorukov Mfg. Co., 407 Fisher Bldg., Detroit 2.**

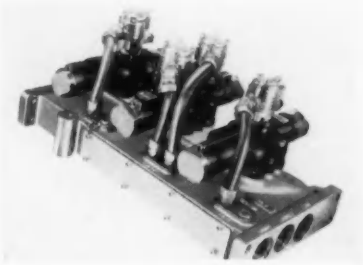
Electronic variable-speed dc drive . . .

uses a grid-controlled, mercury-arc rectifier to govern motors rated at 30 to 300 hp. A 100-hp unit can be contained in a 57 x 24-in. cabinet; weight varies from 1100 to 1500 lb, depending on auxiliary controls included in cabinet. **Reliance Electric & Engineering Co., Cleveland.**

Multichannel oscillograph . . .

permits user to intermingle electrical, pneumatic and mechanically actuated pen

writers on the same chassis. Mobile, sectionalized system is made up of standardized components plus a wide selection of plug-in electronic amplifiers and transducers to record a variety of events occurring simultaneously. **C. H. Stoelting Co., 424 N. Homan Ave., Chicago 24.**



Manifold for group mounting of valves . . .

takes ¾-in. two, three and four-way pilot-operated control units. Made of cast aluminum, the manifold is offered in two and three-station types, has full length inlet and exhaust ports common to all valve stations. A conduit passage for electrical wiring, with removable cover, runs full length of the manifold. Inlet, exhaust and wiring passes are 1¼ in. NPT. Machined for ¾ or 1 in. NPT side and bottom cylinder porting. Adaptable to any control valve application, the high-capacity manifold permits mounting of any combination of single or double-solenoid valves at any location on the manifold. **Valvair Corp., 454 Morgan Ave., Akron 11, Ohio.**

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for timing systems, automatic control systems, data handling, computing and automation meet military specifications for shock, vibration and temperature. Included are cathode followers, pulse gates, squaring circuits, gate amplifiers, dc amplifiers, reset generators, one-shots, flip-flops, gates, crystal oscillators, multivibrators, pentagrids, amplifiers, phantastrons, voltage regulators, blocking oscillators, thyratron ring counters, thyratron pulse generators. **Engineered Electronics Co., 506 E. First St., Santa Ana, Calif.**

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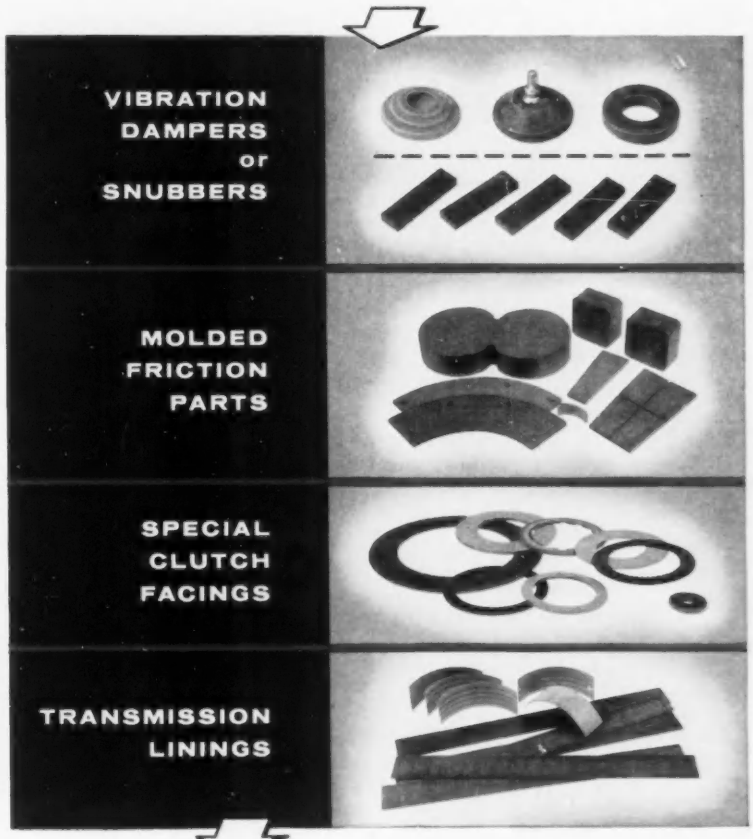

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OCT.

21-23 **National Power Conference,** sponsored by ASME, Americus Hotel, Allentown, Pa. Meetings will cover new developments in fields of power generation and related industries including turbines, pumps and nuclear reactors. For information contact the ASME, 29 West 39th St., New York, N. Y.

22 **Symposium, "Life With Synthetics",** Association of Consulting Chemists and Chemical Engineers, Belmont Plaza Hotel, NYC. For information contact Miss A. B. Bowers, 50 E. 41st St., NYC.

24-25 **Computer Applications Symposium,** sponsored by Armour Research Foundation, Morrison Hotel, Chicago, Ill. First day's sessions will cover business and management applications of computers; second day, research and engineering applications. For information contact Alfred K. Hawkes, ARF.

24 **Engineers' Council for Professional Development,** 4th annual general assembly, Hotel Statler, NYC. Morning session will consider military service and professional development. Afternoon session will cover the community college and trends in engineering education. For information contact the Council, 29 West 39th Street, NYC.

24-25 **Engineering Institute on Effective Drafting,** sponsored by the University of Wisconsin Extension Division. Program will emphasize the problems of supervision. For information contact Robert A. Ratner, University of Wisconsin.

24-25 **Aviation Electric Equipment,** 14th annual display sponsored by the Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles. Attendance limited to persons in aircraft electricity. For information contact Lynn-Western, Inc., 6901 Melrose Ave., Los Angeles.

27 **American Gear Association,** Semi-annual meeting at the Edgewater Beach Hotel, Chicago. For information contact R. F. Klose, 1 Thomas Circle, Washington, D. C.

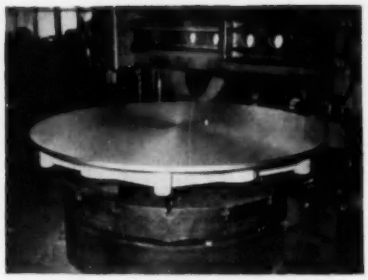
28-30 **National Lubricating Grease Institute,** annual meeting at the Edgewater Beach Hotel, Chicago. Program will include a technical symposium and a contractors' panel. For information contact the Institute, 4638 J. C. Nichols Parkway. Kansas City.

28-30 **Aeronautical and Navigational Electronics,** 4th annual East Coast conference, at the Lord Baltimore Hotel, Baltimore. Technical program will include 41 papers on navigation techniques, equipment design and components. For information contact C. J. Knight, The Martin Co., Baltimore, Md.

28-Nov. 1 **International Atom Week** sponsored by the Atomic Industrial Forum American Nuclear Society. Events include a trade fair, 4th annual Atomic Industry Conference, 2nd winter meeting of the American Nuclear Society, conference on careers in Nuclear Science and Engineering, Conference on Reactor Safety, and the annual conference of the Professional Group on Nuclear Science.

NOV.

2-8 **2nd World Metallurgical Congress** and 39th National Metal Exposition at Chicago. Societies sponsoring events are the American Society for Metals, the Atomic Energy Commission, the American Institute of Mining and Metallurgical Engineers, the Society for Nondestructive Testing, Industrial Heating Equipment Association, Metal Powder Association, and the Special Libraries Association. For information contact American Society for Metals, 7301 Euclid Ave., Cleveland, O.



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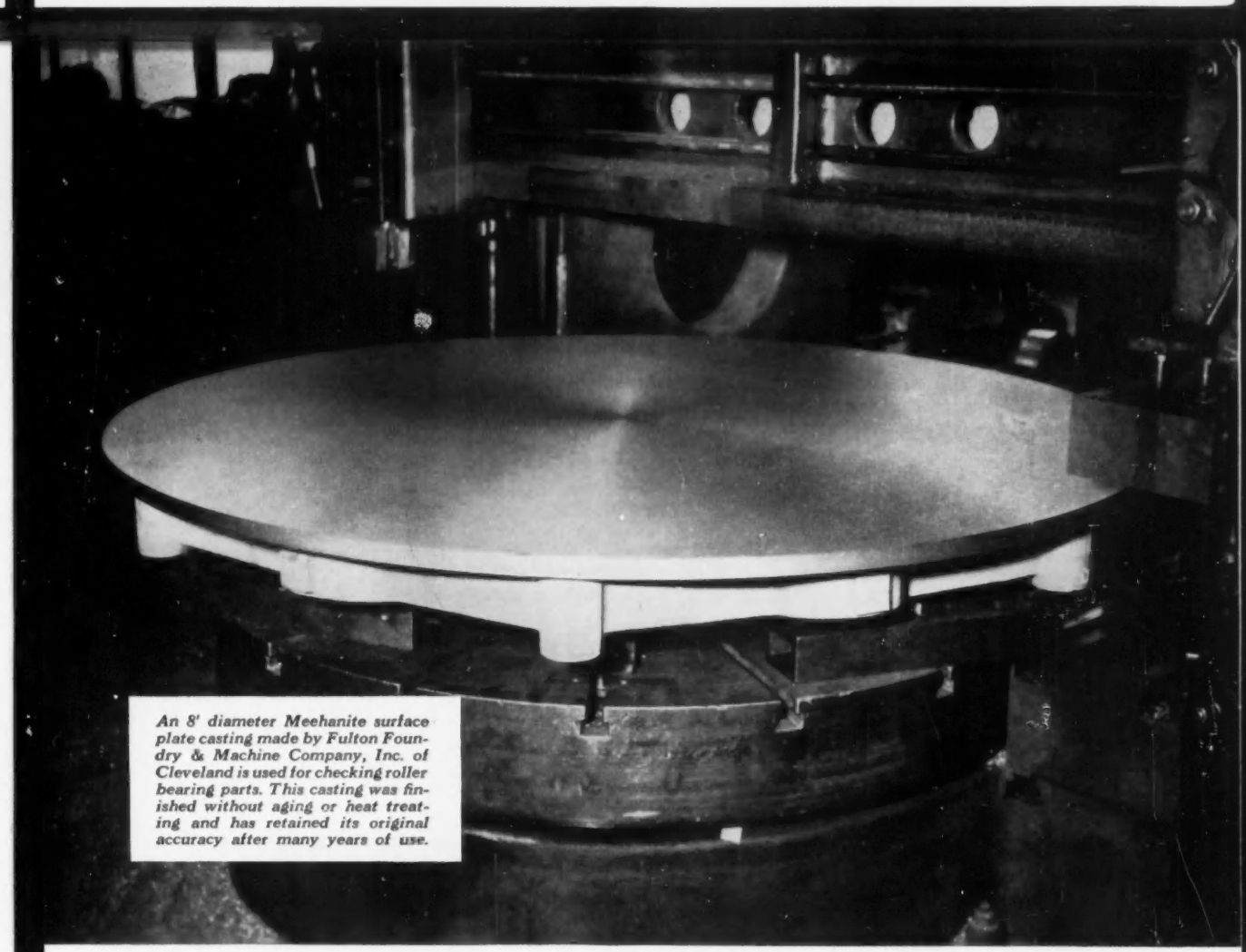

An 8' diameter Meehanite surface plate casting made by Fulton Foundry & Machine Company, Inc. of Cleveland is used for checking roller bearing parts. This casting was finished without aging or heat treating and has retained its original accuracy after many years of use.

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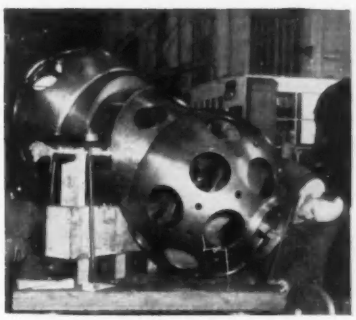
If you have a question concerning the use of Meehanite® in your casting design, consult a Meehanite foundry and write today for your free single copy of "Casting Design As Influenced By Foundry Practice."



Meehanite® was selected in the construction of the Morrison Planetarium Projector because of its ability to maintain dimensional stability. These castings were made by Vulcan Foundry Company of Oakland, California.

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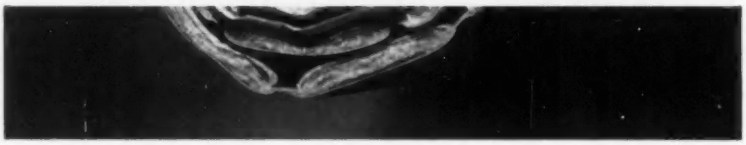

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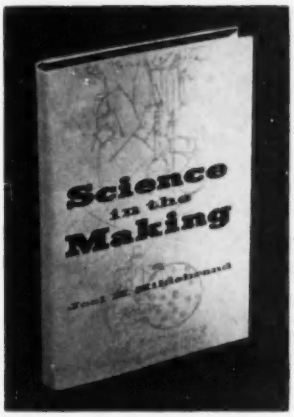

Science in the Making

JOEL H. HILDEBRAND, *Published by Columbia University Press, 2960 Broadway, New York 27. 5¼x8¼ in., 116 pp.* $3.

Ostensibly, the purpose of this book is to explain how scientists attack problems. Its main theme, however, points out the many differences in viewpoint between scientists and nonscientists and the almost uncrossable abyss that separates the two groups. The warning that scientists are regarded as persons to be mistrusted, or at best as narrow specialists, is sounded throughout the book.

Dr. Hildebrand strikes at people "who assert that the world would be better off if science were starved out." He regrets the gullibility of a nonscientific public taken in by advertisements of soaps 99 44/100% pure (pure what?) and tooth powders that make teeth five times brighter (brighter than what?), and laments that a court based the merit of a battery additive on satisfied customers rather than on scientific tests. He notes with alarm that even when there is scientific basis for a claim, the advertiser prefers to hide this from the public under pseudoscientific terms such as "canned sunlight." The book implies that not only has the layman an extremely limited background in science fundamentals but that he is antagonistic toward the scientific approach in problem-solving. The incredible illogic of some of the antifluoridation arguments suggests Dr. Hildebrand's thesis is based on disquieting but undoubtedly valid concepts.

Dr. Hildebrand also examines scientists critically, and is pleased to note they are not ignorant of literature, music and art. Why then, he inquires, are so few others willing to put forth the moderate effort needed for an amateur's knowledge of science? Communication between scientists and nonscientists seems to be a one-way street. As I. I. Rabi noted, "The scientist studies nature in its profundity, beauty and subtlety," but he can also "listen with pleasure to the philosopher, the historian, the literary man, or even the art critic," whereas nonscientists "cannot listen to the scientist with pleasure and understanding. . . . Instead of understanding they have only a naive awe mixed with fear and scorn."

It is regrettable that Dr. Hildebrand fails in trying to show how scientific knowledge is extended. He states his belief that the scientist follows no prescribed method, but he tries to explain this by showing the steps he himself used to solve problems in chemistry and other fields. These sections contribute little except as interesting puzzles in which a problem is first stated and its solution neatly unwrapped.

N. C.

1957 Design Engineering Conference Proceedings

Published by ASME Machine Design Div. and Metropolitan Section, 29 W. 39th St., New York 18. 8½x11 in., 110 pp. $4.

This volume of papers contributed at technical sessions also contains transcript of a panel discussion on procedures used in developing new designs. Subjects covered include: new developments in gearing and cams; metallic, ceramic, refractory materials; plastics and rubbers; coatings and finishes; selection of motors and switching devices; designing for easier machining, handling, assembly; designing for automatic control.

Information-acceptance Rate of a Human

Abstracted from "Reading Rates and the Information Rate of A Human Channel," by J. R. Pierce and J. E. Carlin, Bell Telephone Laboratories.

Fastest rate at which a human can read aloud is used as fastest demonstrable rate at which he can receive and use information. Rate is 40 to 50 bits per sec, and the limitation is described as a mental rather than physical one. This figure agrees with others established visually and may be compared with the 50,000-bits-per-sec rate of a telephone channel of 50-million-bits-per-sec of a television channel.

Miniaturization

Abstracted from "Miniaturization," Electronics, Oct. '57.

Size-reduction programs applied to electronic components and circuitry are the subject of this special report, which discusses such characteristic problems as heat dissipation, accessibility for repair, reliability, new materials, insulation. Design and packaging of miniature equipment, selection of components, production methods are discussed in separate sections.

ELECTRONIC DEVELOPMENT APPARATUS—Catalog, 52 pp. Lists more than 200 components frequently used in control equipment for automatic operation that is available by mail order. Describes in detail such equipment as precision amplifiers, potentiometers, modulators, power supplies, 60 and 400-cps motors, synchros, breadboard equipment and a variety of functionally packaged units. Also includes an opening section that explains uses and advantages of the products, and indicates how engineers may select the proper components to achieve a specific goal. Servomechanisms, Inc., 625 Main St., Westbury, N. Y.

WIRE, ROD, STRIP—Price Schedule 12, 32 pp. For purchasing agents, this is a price list with simplified procedures for use; for engineers, it is a technical handbook offering data on chemical, physical and mechanical properties of alloys available. A separate section tells how to save money in metal purchasing. Techalloy Co., Inc., Rahns, Penna.

BLIND BOLTS—Catalog, 8 pp. Discusses advantages of this curved recess-head fastening, which is tightened with a circular driving blade that can be operated at any angle. Engineering drawings of structural applications, installation suggestions, and design considerations are included. Hi-shear Rivet Tool Co., 2600 W. 27 St., Torrance, Calif.

MINIATURIZATION OF SELF-LOCKING NUTS—Brochure 5711, 36 pp. Discusses reduction of fastener size and weight, fastener configuration and the relative importance of each factor. Comparison charts show weight, size, temperature and material for nuts. Text and cross-sectional drawings on basic miniature nuts. Dept. P, Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.

METAL MOLDINGS—Catalog 10 C, 48 pp. Information and specifications on moldings fabricated from stainless and cold-rolled steel, brass, bronze and aluminum. With photos, diagrams, and dimensional drawings. John Lees Div., Serrick Corp., Muncie, Ind.

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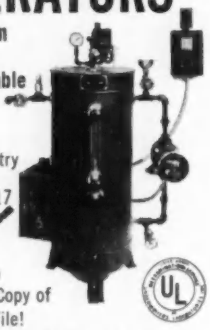

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Publisher's Postscript...

NEEDED: IMAGINEERING TIME

Not too long ago, top management was proudest of the new employee cafeteria or glamorous new uniforms for company soft-ball or bowling teams. But times have changed. Today management boasts most of its new research and product-development facility.

It is estimated that $7.3 billion is being invested in such facilities this year and by 1960 the yearly investment should exceed $9 billion. New buildings are erected–separated from present manufacturing. Elaborate testing facilities, high-precision machine shops, and extensive engineering and research facilities are included.

A vast output of new and improved products will become available in the years ahead as a result of this investment (see Oct. 7, p. 30), and they will be needed. If production is to continue to rise 3 to 3½% a year in the face of increasing pressure for shorter hours, more efficient production equipment and products are imperative. The 40-hr week may drop to 35 hr in the next seven years. People are working less and earning more.

There is a great new market agrowing. What an opportunity for an imaginative engineer to develop new recreational products! Consider the recent sales in boats, outboard motors, fishing tackle, golf and hunting equipment, high-fidelity and portable radio sets, to mention a few.

New electronic devices, more powerful ceramic magnets, compact gas engines, smaller electric motors, the many new materials–all will find applications in new products, appliances, and home recreational equipment to interest and entertain us.

The market is just beginning to grow–it won't reach its full potential until the middle sixties. New product-development facilities will go to work in earnest once the market is revealed–but what's wrong with a little imagineering right now? Take a look at a new idea or two–"try it on the dog," and perhaps consider some product diversification in this direction.

Here's an exciting new potential–but it needs imagineering time now!

–A. H.

READER TO EDITOR

Are We Short of Engineers?

To the Editor:

What does it take to awaken people like you to the facts of life? There is *no* shortage of engineers. There is *no* shortage of engineers. There is *not* a shortage of engineers. There is a shortage of technicians, draftsmen, and specialists!!! There are *thousands* of engineers in the aircraft industry today who are doing work that can be done by technicians or by draftsmen. Why are they doing it? Simply because engineering jobs are not available.

As an example, there are approximately 2700 engineers available in Seattle who would love a crack at engineering. They are presently employed in the positions previously named but under glorified job titles. They have migrated here from all over the country. Perhaps you could tell me why they would accept the job offered if they had engineering jobs available elsewhere.

I mentioned that there is a shortage of specialists. Certainly radar experts, inertial-guidance experts, infrared experts, weapon-system analysts, etc., are in demand and cannot be found. There is also a terrific difference between the salary levels offered for these people and what the average engineer can demand. Here is the true test of any so-called shortage. What has happened to the salary structure?!!

Before you and people like you, especially those who by editing technical magazines are supposed to perform services for the engineer, toot your horn about something you obviously know nothing about, find out what the true situation is.

W. J. Gariss,
Bellevue, Wash.

Ed—*Reader Gariss failed to see earlier editorials and articles, notably "Raiding Is Not Recruiting" (Feb. '57), and "Poor Utilization of Engineers" (Sept. 23, '57), in which we pointed out the uneconomic use of engineers by some companies. There is, however, great disagreement on what engineers should do, how they should do it, and whether or not they are being used efficiently. In this case, Mr. Gariss failed also to note that the editorial discussed the long-term problem of the engineer shortage, not the momentary one. As to knowledge of conditions*

F.Y.I. (personal)

Tie These On

A pocket-sized alarm timer that can be set for any interval from 5 min to 3 hr, 50 min, a music box that plays a pretty tune, and a miniature slide rule all come attached to necktie bars. Damar, 868 Damar Bldg., Elizabeth, N. J. sells the timer and the musical tie pin (both made in Switzerland). The timer is $6.98; the music box, $10.95. (Matching cuff links and earrings are available, for $12.98.) The slide rule is decorative rather than functional. But it's so perfect a replica that it looks as though it could work. It's tiny and good-looking too. Retail price is $2.50 (plus 10% tax). Quantity prices are considerably lower. McKenna Company, 700 Prairie Ave., Providence, R. I., makes it.

Tornado Tattletale

Why sit around worrying about an impending storm? Now you can be sure, says Max Griffin of Oklahoma City. He has designed, and is beginning to market, a Tornado Alarm that works somewhat like an automatic sprinkler system. Everybody knows, Griffin says, that barometric pressure takes a nose dive before a tornado arrives. So, he has hooked up a barometer with an alarm buzzer: The barometer needle will set off the alarm when the critical barometric pressure is reached (he's set it at 29.10 in. Hg). Battery power is provided, to assure operation even if electric lines are knocked out. Address: 1811 NW 17th St., Oklahoma City.

Attract-ive Products

Build in a magnet if you want to build sales . . .

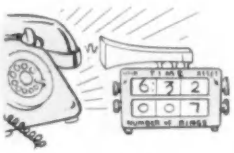
That's a motto a lot of companies seem to be taking to heart. National Carbon, for instance, offers a flashlight with a magnet built into the switch—to hold fast to a car fender or dashboard, or the underside of the kitchen sink—and free both hands for repair jobs. The case itself is polyethylene plastic. List price is $1.99.

Lewis & Conger's mail order division, Mineola, L. I., N. Y., is featuring a "magnetic tie rack" and a magnetic bottle-opener. The rack, specially designed to hold clip-on bow ties (24 of them; it also has side-arms for standard ties) is priced at $2.95. The bottle-opener, a fancy model that also serves as recapper, uses its magnet as a hang-up device. It, too, is $2.95.

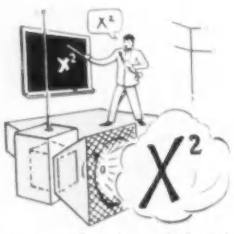
Opportunities to use magnets in machine design are, of course, almost unlimited—as latches and clamps, in timers and controls. (For design information, see Sept. 30, p. 94.)

WHY DON'T THEY RESEARCH and DEVELOP . . .

. . . a golf ball with radioactive tracer? Medical researchers have made good use of radioactive elements to follow substances through the human body. In analagous fashion the golfer might carry a small, radiation-sensitive device which would lead him directly to his ball, no matter how rough the rough.



. . . an indicator which would show when an unattended telephone or doorbell had rung. Important calls are often missed during that moment in the backyard or at the corner grocery. Answering services are expensive as are the newer automatic telephone answerers including a taped message. In its simplest form, the device would be attached directly to the bell circuit and count electric surges each time the bell sounded. A more useful design might be triggered by the bell sound and, if transistorized and battery powered, it could be placed at door or phone as desired.



. . . a microphone-radio combination that would dispense with long connecting wires between speaker and amplifier. A small portable FM transmitter could be built into the microphone body or be concealed in a pocket to permit real mobility for speakers, actors, TV and movie performers. The amplifier would receive the demodulated radio signal, amplify it, and record or send to speakers in the theater.

And—a general plea for more true portability. Maximum dimensions for equipment from a recent study of Navy test instruments are: 8 in. wide, 18 in. long, 18 in. deep. Maximum weight: 14 lb. Let's see more TV sets and tape recorders meet these specs!

Have you a pet project but neither the time nor inclination to do the necessary R & D—Product Engineering will welcome (and identify the originator of) similar ideas based on known scientific principles but lacking an inspired manufacturer

about which we write, we respectfully suggest that visits of our 27 editors, and our freedom of access to the great number of studies and opinions available, may give us a broader base upon which to draw conclusions than he may suspect. —*EJT*

To the Editor:

Your editorial "Are We Short of Engineers," in the Sept. 23 issue of your magazine is subject to debate. I recommend you obtain a copy of the book *The Demand and Supply of Scientific Personnel* by D. M. Blank and G. J. Stigler, published by the National Bureau of Economic Research, 200 pp, $4. It contains some highly revealing facts debunking popular misconceptions on the so-called shortage.

H. Singer
Association of Professional Engineering Personnel

Ed—*The intent of the editorial in question was to discuss the long-term situation with regard to engineers, as stated in the first paragraph, not to become embroiled in any argument regarding the current situation. Apparently the wording of that paragraph was not sufficiently clear.*

The book suggested by Mr. Singer is itself the subject of a very serious debate among economists reported in Product Engineering for Sept. 9 on pages 33 and 34. The point at issue in that debate was that the authors drew rather sweeping conclusions based on 1954 statistics, while more recent salary surveys have shown larger than average increases for engineers in the last three years. Surveys by the E.J.C., for example, show a 25% average increase in salary from 1953 to 1956. Compare this with Dept. of Commerce figures citing a 12% rise for all wage and salary employees during the same period, a 14% rise for physicians and 19% for lawyers. Engineers' salaries did not respond immediately to demand because the statistics include salary levels for government-employed engineers whose salaries rise only by usually long-delayed government action, and many others are employed by aircraft companies who have maintained antipirating agreements. —*EJT*

What Is an Engineer?

To the Editor:

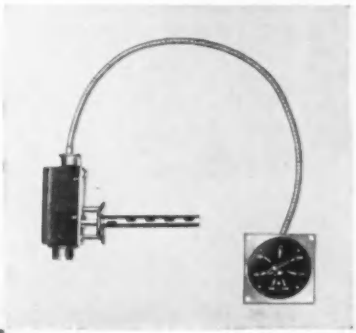
I wish somebody would give me a good definition of an engineer. I've heard of sanitation engineers, food engineers, safety engineers, human engineers, sales engineers, *et al.* This ambiguous "engineer" seems to be something that is in short demand here, bragged about in Moscow and mishandled in Washington. Please, what is this "engineer"?

Albert Damelio

Flexible Shafts Withstand Temperature Extremes!

A leading aircraft manufacturer has used S.S. WHITE flexible shafts for many years to transmit control between this graduated dial and aircraft thermostat. He finds that under any kind of temperature conditions, there is no measurable variation in torque to turn the shaft, or in torsional deflection required to initiate cam movement over the temperature range!

This ability to withstand temperature extremes is only one of the many remote control and power drive advantages industry has discovered in S.S. WHITE flexible shafts. Perhaps they can help you to simplify control or product design . . . cut your production costs . . . speed assembly. These quality shafts range from small to large sizes, and up to 12 feet in length. The assistance of our engineering staff in helping you work out a flexible shaft application for your product is yours for the asking. Just write to

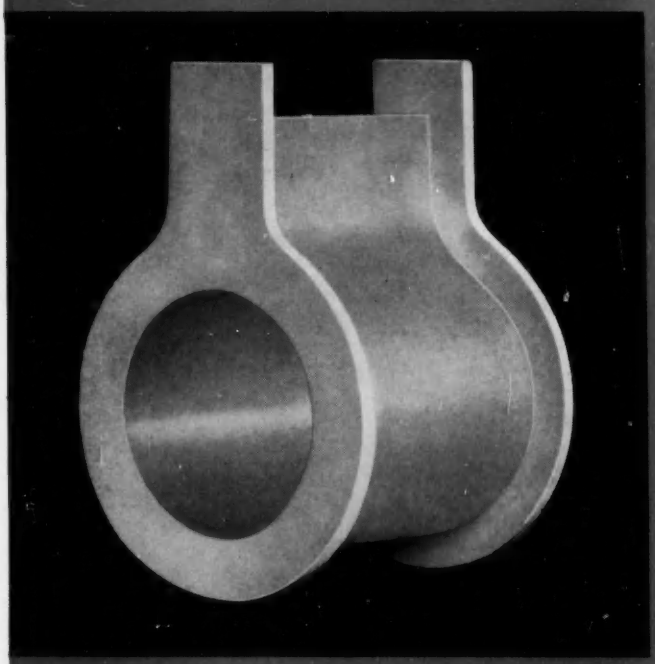


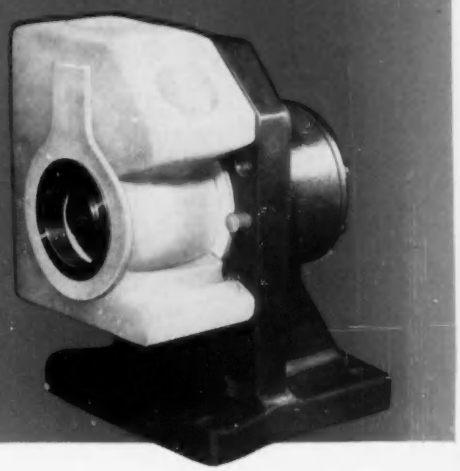
FIRST NAME IN FLEXIBLE SHAFTS

USEFUL DATA on how to select and apply flexible shafts. Write for Bulletin 5601.

S. S. White Industrial Division, Dept. D, 10 East 40th St., New York 16, N. Y. Western Office: 1839 West Pico Blvd., Los Angeles 6, Calif.

PUMPS FUMING NITRIC ACID 14.7 MILLION CYCLES





...and the Heart of this Vanton Pump is C/R Sirvene

Vanton Pump engineers knew what they wanted—a flexible liner for their unique Flex-I-Liner pump that would permit the handling of red and white fuming nitric acid, hydrogen peroxide and other strong oxidizing agents. In addition, high flexibility had to be combined with positive sealing efficiency to protect the rotor, shaft and bearing from contact with the corrosive chemicals. For almost six years Vanton engineers tested various liners and found none that could withstand these unusually severe specifications. Then they turned the problem over to C/R Sirvene engineers. They got the liner they wanted in a matter of weeks. C/R's Sirvene liner, based on the Kel-F elastomer, meets every specification and has been performing dependably for as long as 14.7 million cycles.

If you have a sealing problem—equally critical or simple—C/R Sirvene engineers can help you. They're recognized leaders in the compounding and molding of elastomers for fluid sealing and related applications. They have the research and facilities to solve your problem quickly and economically. Write them direct—or send for the informative new booklet, "Sirvene."

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